

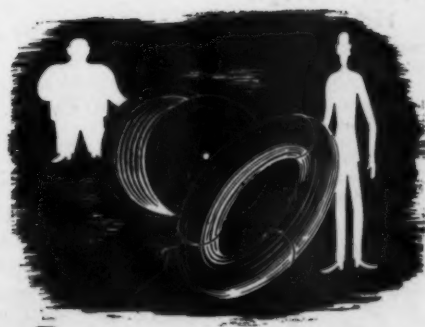
ENGINEERING • INSTALLATION • MAINTENANCE

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*Maintenance
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PAGES 41-52

Electrical contracting



JUNE • 1940



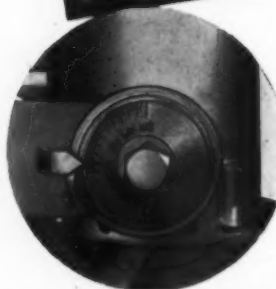
New!

A Floodlight for Sports-field Lighting that's Easy to Service

Type L-68 Opens New Opportunities for Profitable Floodlighting

IF YOU'RE looking for a floodlight that's easy and inexpensive to install and will give your customers year-after-year satisfaction—recommend the new Type L-68. Installation is simple; for example, all crossarms can be drilled alike because the mounting bracket permits 180-degree horizontal adjustment.

It's easier for you to sell because of three related features—a 240-degree tip-over to raise the floodlight to servicing position, a repositioning stop to return the unit to the lighting position, and a slide-type door glass to make servicing easier. These helpful features—exclusive to the Type L-68 floodlight—are extremely valuable for sports-field installation. Yet, they cost you nothing extra.



Resetting Ring Returns Floodlight to Proper Position

The conveniently placed clamping bolt and easy-to-read degree scale speed up installation and aiming of the floodlight. After the installation is adjusted, the resetting ring is fastened in place. Relamping and servicing

are simple, as the special repositioning stop allows the light to slip back into correct position.

240-Degree Tip-over for Quick and Safe Servicing

The Type L-68 floodlight can be tipped back by loosening one bolt to enable relamping and cleaning with safety. Servicing becomes simpler because the front of the floodlight faces the operator so he can work on it easier—there is no awkward or unstable working position.



Slide-type Door Glass Easily Removed

To remove the door glass it is necessary only to unsnap one large toggle latch. A slight pull on the handle, and the door frame slides off—completely detached from the reflector. The cover glass is prevented from falling by a length of heavy-duty chain, and is safely and conveniently out of the way where it

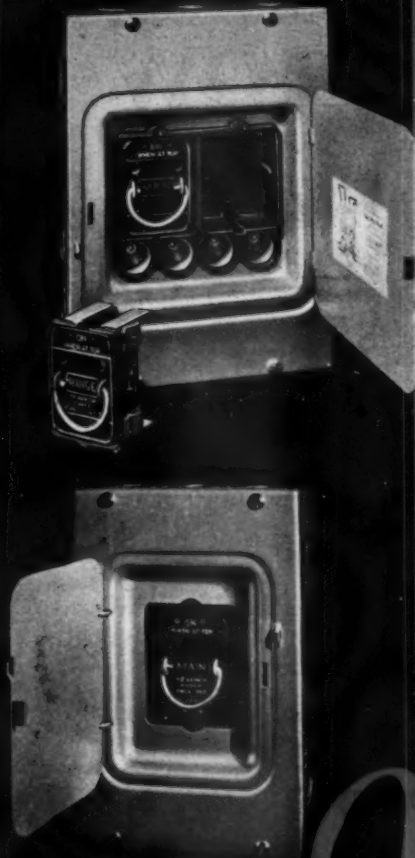
will not hinder servicing. The glass is not liable to be broken by dropped tools.

GENERAL ELECTRIC

451-6



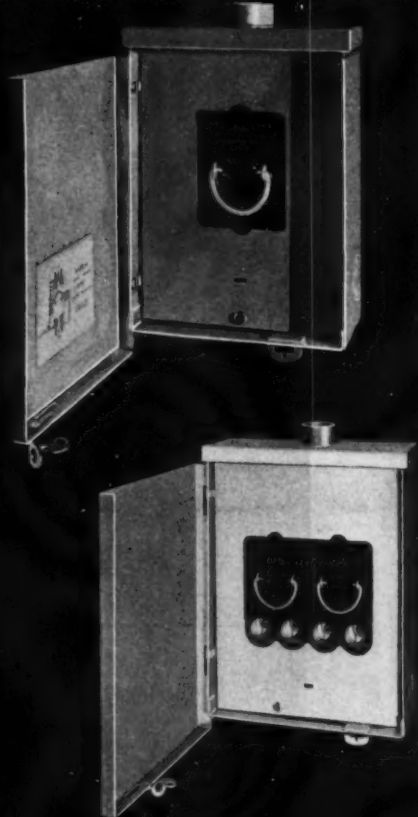
Indoor and Outdoor



NEW, smaller, better looking—with years-ahead *interior* design (left), giving much more wiring space than other types. Available as service or range switches,—or for service and range duty, (1) with a single switch for either; also (2) with separate switches, one for service and one for range duty; (3) with or without branch lighting circuits.

OUTDOOR types (right) differ from indoor only in box construction. The door, in closing, is slid up under the "roof," which overhangs the sides so deeply that the hardest storms stay out. Indoor and outdoor types equally easy to install.

SWITCH units of one-piece Bakelite — compact and practically indestructible. It is impossible to insert the pull-outs incorrectly. Metropolitan Device Corporation, Brooklyn, N. Y.



PULL-OUT TYPE RANGE & SERVICE SWITCHES

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

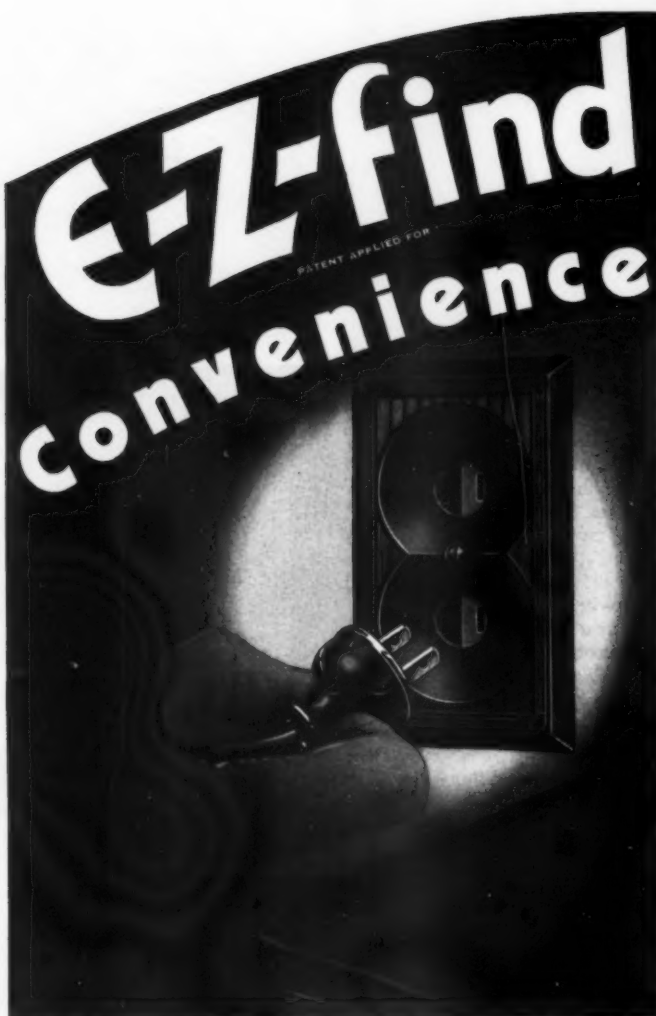
Send information on pull-out type switches, as well as catalog of Murray Switches.

Name.....

Company.....

Address.....

Mail for Switch Catg.



Duplex Outlets

introduced by

ARROW

*Behind tables, lamps,
davenport — in dark
corners anywhere . . .
as easy to use as if spotlighted!*
The plug blades slide into the
center from any point on the
curved surfaces of the plate.

New

*The design that finally
accomplishes the aim of every
Convenience Outlet . . .*

A REAL "E-Z-Find" Feature!

Note that the center-finding surface extends *beyond* the receptacle body; it's in the *plate*! The flaring, curved surfaces of the plate guide the plug-prongs to the center of the "dished" area, so a slight pressure against the central (vertical) ridge slips the blades into the slots . . . This device lifts Duplex Receptacles from lower-price competitive types. Gives wiring jobs a positive **DISTINCTION** in utility and style. Steps up the quality of the job in a way that customers can *see*!



No. 4601 Receptacle,
Brown Bakelite

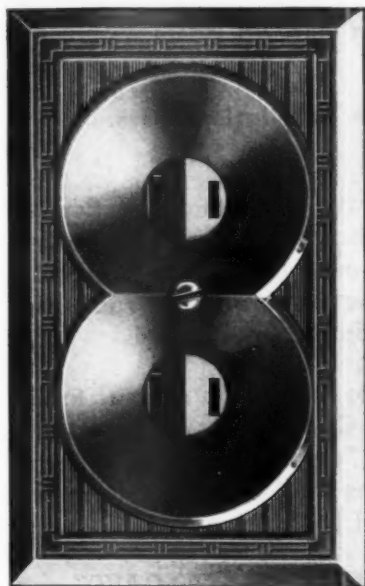
SOLD THROUGH YOUR

ARROW ELECTRIC DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

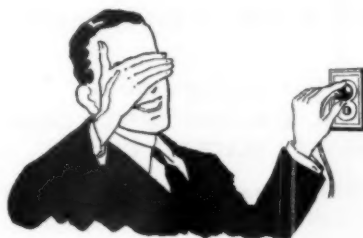
ELECTRICAL WHOLESALER

Entirely Different



No. 4600-I Receptacle and Plate
Complete, Ivorylite

finding feature that slides the plug prongs to the exact plug-in position from any point in a wide area; (2) The *center-trapping* feature that indicates by a definite drop that the plug has been centered and should be turned to the contact slots (mere pressure practically does it); (3) The *center-holding* feature that holds the plug centrally while turning the blades into the slots. Never did you have so many talking-points in a Receptacle. Order by catalog numbers given below — in time to get the advantage of showing this number *while it's new!*



Close your eyes and try it . . .
Prove how easy the plug goes in!

ARROW E-Z-find

PATENTS APPLIED FOR

EASILY the greatest of all improvements in Convenience Outlets, from the standpoint of your customers. *More* than an improvement, — a new departure in functional design. In all former designs the finding grooves have been confined to the face of the receptacle. Now this essential convenience-feature has been extended to the plate; the combination of receptacle and plate forms a self-locating surface for any plug cap. You can close your eyes and "plug in" without fumbling.

**The curved surface
does it!**

Technically speaking "E-Z-find" Receptacle has these exclusive sales-features: (1) The *center-*



No. 4600

BROWN BAKELITE

15 AMPS. 125 VOLTS, 10 AMPS. 250 VOLTS

CAT. NO.	LIST PER C.	DESCRIPTION	STD. PKG.	CAR-TON	PKG. WGT.
4600	\$26.00	Receptacle and Plate	100	10	20
4601	10.50	Receptacle	100	10	14
4602	15.50	1-Gang Plate	100	10	9

IVORYLITE

15 AMPS. 125 VOLTS, 10 AMPS. 250 VOLTS

CAT. NO.	LIST PER C.	DESCRIPTION	STD. PKG.	CAR-TON	PKG. WGT.
4600-I	\$37.00	Receptacle and Plate	100	10	20
4601-I	16.50	Receptacle	100	10	14
4602-I	20.50	1-Gang Plate	100	10	9

SOLD THROUGH YOUR

ARROW ELECTRIC DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

ELECTRICAL WHOLESALER

"UNDERGROUND" use *Orangeburg* **NOCRETE CONDUIT** for **2** **EXTRA PROFITS**

- 1** Savings in material costs.
- 2** Savings in installation costs.

Perhaps you now have a house connection to make, a garage or barn to hook-up; an industrial power, lighting or signal service to install? Use **NOCRETE** for that underground "run" and you will realize its profit opportunities.

NOCRETE is easy to install, no special tools. The new 5° Angle Coupling permits making offsets and savings "on the job." All fittings, ells, bends, reducers and adapters to other conduits are stocked for quick service.

For 47 years "**ORANGEBURG STANDARD**" has been used by the electric industry for power raceways underground-encased in concrete.

Now, new **ORANGEBURG NOCRETE** for the first time makes this quality raceway material available for the smallest job as well as the big distribution project, — without concrete encasement.

—And, it is easy to get from our

Sales Agent—Distributors

**GENERAL ELECTRIC SUPPLY CORP.
GRAYBAR ELECTRIC CO., INC.**

Sales Offices near you—warehouses for prompt delivery within your district.

NOCRETE conduit assures you of:

1 Savings in material costs

Orangeburg **NOCRETE** conduit is about half the cost of metal pipe and less than non-metallic conduits of any comparable quality. Ask our representative for prices. Extra couplings and all types of fittings, ells, bends, etc., are available.

2 Savings in installation cost

It "handles easy"; light in weight, in handy 5 or 8 foot lengths (in various sizes) this super-sturdy duct will surprise you by its adaptability. It assembles and installs easier, faster and at a lower cost than any conduit you have ever used. It is readily cut and fitted with ordinary wood-working tools.

Approved by Underwriters' Laboratories, Inc. for installation underground (without concrete encasement) — Guide Card 60-014 File E 2557

**[MADE AT ORANGEBURG, NEW YORK
BY THE FIBRE CONDUIT COMPANY
292 MADISON AVE. NEW YORK CITY]**

electrical contracting

With which is consolidated *The
Electrict and Electrical Record*
Established 1901

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| 38—Estimating | 94—Advertisers' Index |

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A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction — industrial, commercial, and residential.

THREE-HUNDRED-MILLION-DOLLARS! Say, did you see this? It says that over \$300,000,000 is being spent this year on Electrical Modernization.

MY SHARE IS COMING IN ALREADY! As soon as I read it, I went down to my Anaconda Distributor and got copies of Anaconda's Wiring Survey and Guide. Ten days after I put them to work, I was given a re-wiring contract for \$4,500. I used Duracode too—that's Anaconda's all-purpose building wire.

Right now I'm figuring on another job that will mean better than a thousand dollars to me. How about you? Why don't you get this new survey and go after some of the big money?



Without obligation send me a copy of Anaconda's new Wiring Survey.

Company Name _____

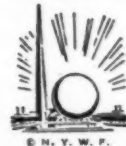
Address _____

Title _____



If you are unable to obtain copies of the Wiring Survey from your Anaconda Distributor, use this coupon!

Visit the Copper & Brass Industry Exhibit in the Hall of Industry, New York World's Fair—1940.



USE MODERN IMPROVED

Anaconda Wire & Cable

ANACONDA WIRE & CABLE COMPANY, General Offices: 25 Broadway, New York City; Chicago Office: 20 North Wacker Drive
Subsidiary of Anaconda Copper Mining Company. Sales Offices in Principal Cities

JUNE, 1940

Darned Important People

A FRIEND OF MINE MAINTAINS THAT KNITTING is a good thing for women.

He says it gives them something to think about while they are talking. Myself, I don't know about women. When it comes to electrical contractors, however, it is different. And we need more knitting in this industry right now.

WITH A SUDDENNESS THAT HAS LEFT US DIZZY, new construction has been knocked from its throne as the controller of our business. In past years the "building season" has started our year with a small crew, built that crew up maybe ten times through spring and summer, taxed office forces and drained bank accounts. Then winter has laid off most of these good men.

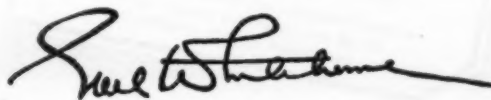
LABOR, TOO, HAS BEEN BADLY HURT. Men who needed work have had to be idle. We had no work to do. There was no building. Trade union officials have been driven to their wits end trying to spread what work there was in dull times and not unnaturally have "cashed in" for their members when boom times brought demand for more men.

WHAT ELSE WAS THERE TO DO? Nobody knew. But now we see a new kind of work, a new system of operation, a new additional kind of business about to make a new world for us to work in.

WHAT DO I MEAN? I mean fluorescent lighting. I mean small diameter wire. I mean other new developments that are ahead of us. Here lie two rich new visible markets. And everybody waits watching these two good things—waiting for the boom. But without knowing it they are really waiting for the electrical contractor to recognize these two opportunities and make them his own. For he must be the boom starter. With them he can build a staple year round business. He can shake off the building season.

WE TAKE ALL THIS TOO CASUALLY. We think it is just another little turn in our affairs. But really these are two revolutionary developments that have made the contractor the key man in the electrical industry right now. For he is the man who must lead in this great new movement towards prosperity.

STOP THINKING THINGS HAVE GONE TO HELL. Look around at the facts of the situation. We're darned important people. Let's start acting that way.



MEASURE THE *Job-Getting* VALUE OF *Inch-marked* ELECTRUNITE STEELTUBES




New patented bender makes accurate bends simply and quickly. Directions cast in side are easy to follow, even for "tricky" bends. Ideal in combination with "inch-marked" STEELTUBES.

THE MODERN ELECTRICAL RACEWAY

Here's one of the key items you've been looking for to permit lower bids without lower profits. With this cost-saving, time-saving raceway, you can now get some of those jobs that have been "holding off" because of high wiring costs. » » » This modern resistance-welded electrical raceway costs less to buy — less to install, yet it meets requirements for most wiring services. Assembled without threading with water-tight compression fittings, STEELTUBES may be accurately bent to fit around columns, beams, and other piping. Newest time-saving feature is *inch-marking* (feet and inches) for quickly cutting to size. Write GRAYBAR today for Bulletin C-938 giving all the facts. Graybar Electric Company, Graybar Building, New York City.


NEW CODE NOTICE—1940

Code changes permitting use of small diameter building wire in new and existing conduits are now pending. GRAYBAR can give you up-to-the-minute information on all types of this wire and its use as approved by local authorities.



"We look to the GRAYBAR people to keep us informed of improvements that can help us to get new business at a profit."

— says Electrical Contractor J. McN.
(No. 16 of a series of 10-second "quotes" from typical Graybar customers.)



Distributed and guaranteed by

Graybar
ELECTRIC COMPANY

INDUSTRY ORGANIZES

For National Defense

ALERT to what is happening in Europe, the American people are setting out to strengthen their defenses against aggression from any quarter. Already the government has laid down an initial program to that end.

The surest defense against aggression is the ability to resist it. If we are known to be well prepared we may avert attack. If we cannot avert it we shall be armed against it. But preparedness against war means preparedness to wage war.

And modern war is an industry. Like every other industry, it is a matter of men, materials and machines. Fighting men must be skilled workers, trained to use an arsenal of special tools and equipment that are just as diversified and just as essential to success as those of any other industry.

The plant, supplies and personnel of war must rival in efficiency those of any peacetime industry. For the stakes of success or failure in war are not paid in money profits or losses: they are paid in the lives and property of the people, in the security — perhaps the survival — of a nation.

* * *

Sound national defense calls first for a comprehensive program, carefully planned to back up a clear-cut policy as to what we expect to defend. Next comes the appropriation of funds to realize that program. These first steps are vital: they are up to government.

Then program and appropriations must be translated into performance. Native raw materials must be produced, processed and stored. Our meager supplies of strategic materials of foreign origin must be built up until we have accumulated ample stockpiles against the use and wastage of active war. And most urgent, because it is most complicated, raw materials must be manufactured into the innumerable items required to equip the modern army.

We of McGraw-Hill, living with American industry as we do, are keenly aware of the effort that will be required to produce the materials and equipment now needed to modernize our national armament.

Tanks and anti-tank guns, airplanes and anti-aircraft guns, machine guns and automatic rifles, trucks and tractors, destroyers and supply ships — these are but a few items from the endless inventory of military and naval equipment that we must produce by scores, hundreds and thousands, even to arm an Initial Protective Force, behind which we might rally our national resources for decisive effort.

Obviously the army and navy must count on American industry for an ample and continuous supply of this equipment, and industry must organize to produce it in vast quantities. This means the construction and adaptation of manufacturing, transportation and storage facilities, the organization of competent executive and technical staffs, the training of skilled craftsmen in numbers adequate to maintain exacting production schedules. All this, in itself, is an industrial organization problem of the first magnitude, but upon it is imposed still another and vital specification — *sustained speed*.

For time is the all-essential ingredient of modern war. It cannot be bought with any appropriation, however great; once lost, it cannot be recaptured; we must make effective use of it while we still have it. And at this juncture we have none to waste in fumbling, jockeying or experiment.

* * *

Two courses are open to carry out such a program.

1. We might adopt the totalitarian plan of nationalizing industry, conscripting the wealth and labor of all, and suppressing the normal incentives and management of industry in favor of the authority and control of government officials.

2. Or we can stick to the American way of achieving national unity and efficiency by intelligent cooperation between industry, labor and government.

There are those to whom the first will appeal as being the more direct. But I am convinced that most Americans will insist that the job be done in the American way. And in this preference the President, speaking for government, already has indicated his concurrence.

But effective cooperation in so complex and unfamiliar a task demands the utmost of mutual understanding and confidence from all concerned. Confusion of purpose and conflict of opinion are bound to arise—have, indeed, already arisen. Needs and capacities in many fields must be reconciled, relative priorities for various products must be determined, specific parts of the whole program must be allocated, supervised and coordinated with other parts. Government officials, smarting under the whip of urgency, must render quick decisions on highly technical matters, while industrial executives, masters of their own operating technique, must adapt themselves to arbitrary and unfamiliar requirements.

Under such conditions, many problems will arise that must be worked out between the men of industry and those of government. Some of them will be the more acute because of the restrictions under which industry has had to work during recent years—restrictions that have curbed not only the expansion of plant capacity, but also the development of improved processes and the supply of skilled workers. Now, from this sag in our industrial growth, many departments of industry must undertake an overnight expansion of capacity to meet the exacting time schedules of national defense. So industry must look to government for the cooperation that will enable it to expand its facilities promptly and yet write off in reasonable time its heavy emergency investments.

* * *

If we are to deal wisely with these situations, and many more we cannot now foresee, everyone engaged in any part of the defense effort must be willing and able at all times to get a fair understanding of the problems of the others. To help maintain such an understanding McGraw-Hill is peculiarly fitted.

1. By the organized exchange of views and information among our 24 papers, we can help to coordinate the thinking and practice of the 1,000,000 executives, technicians and operating men who are their readers, in matters that have to do with their part in the defense project.

2. Through constant contact with government agencies and the men of industry, our papers can interpret to industry the needs and policies of government and to government the problems and requirements of industry.

3. For the men of industry, each of our papers will expand its regular service as a clearing house of technical and operating data, with special reference to the needs of plants that are producing defense materials and equipment.

To forward these objectives we have set up within our

company a National Defense Editorial Board. It is composed of the chief editors of our publications that serve the functions and industries that are of key importance to the defense effort. Made up of men intimately familiar with the personnel and practice of their industries, this board will stimulate and supervise the activities of McGraw-Hill papers insofar as they can contribute to the defense effort. It will outline basic editorial themes, directed to the forwarding of that project, to be adapted by each paper to the special needs of its specific field.

The board will keep close touch with industrial executives and technicians so as to keep abreast of new problems as they arise. It will maintain contact also with government defense agencies and keep our editors posted as to government objectives, plans and problems. Thus it will function as a link between the several governmental defense agencies and the McGraw-Hill editorial organization, and so help each editorial staff to develop a program best suited to the special problems of its industry.

* * *

In thus undertaking our part in an extraordinary industrial effort, we shall not neglect the normal concerns of American industry. So far as may be consistent with the paramount needs of national defense, production and distribution of the goods and services normally consumed by the American people must go on. The effort to mobilize industry for the national defense must be, in large measure, an additional job and an added burden.

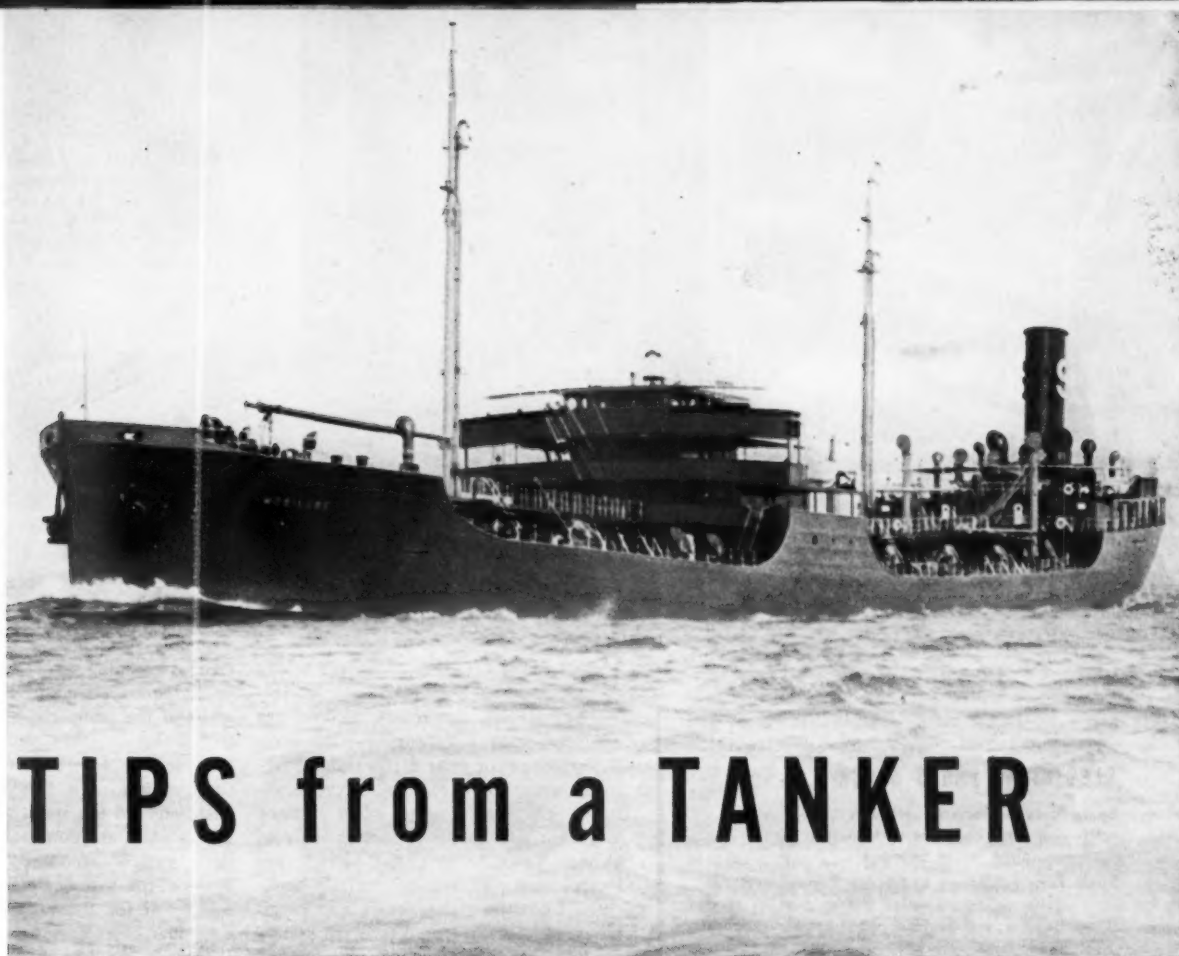
That burden is within the capacity of the American people. But it will not be light. And if industry is to carry successfully its heavy share of that burden, it needs the full cooperation of every industrial function.

For more than seventy-five years, through peace and war, McGraw-Hill publications have served to interpret between the various departments of industry and between industry and the American people. Today, as we face these new problems, there is a new and urgent need for interpretation between the industries we serve and the government to which we all bear allegiance. It is fitting that McGraw-Hill should undertake this effort. To it I pledge every resource of our organization.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.



TIPS from a TANKER

By August Eckel

MODERN civilization is constantly requiring more oil and its resultant products to satisfy the huge demands of its industrial, residential and commercial enterprises. Transportation of crude oil in large quantities presented a problem which the oil industry quickly solved by transporting it in bulk, in the familiar oil tankers which we see steaming up our rivers, lakes and along our coastline. Today large oil companies own fleets of several hundred tankers of from 12,000 to 18,000 tons cargo dead weight, each of which annually averages over 90,000 miles of travel in 300 days at sea.

There are large compact power plants lodged in the hull of these ships. The latest type ocean going vessels are generally propelled by a high pressure steam turbine reduction gear drive. Two auxiliary turbines on each ship drive two 300 kw, 240 volt, direct current generators which supply the neces-

A complete mobile electrical system plying the high seas has to withstand the abuse of a combination of atmospheric, moisture and hazardous conditions. Installation and construction features can be applied by the average contractor to solve many similar problems in his own industrial and commercial work.

sary electric power and light. One 50 kw port service generator is used when the ship is in port loading and unloading its cargo. The two main generators must be identical and interchangeable and arranged to operate singly or in parallel with the voltage to be maintained constant under rapid variation of load, with no flickering of lights when motors cut in and out.

Electricity is being more frequently used for auxiliary equipment and presents many problems which are being skillfully solved by marine engineers. Conditions on a tanker are as complex a mixture of moisture, corrosion and hazard as are met anywhere. Moisture

and corrosion from the salt water and air must be contended with. The hazard of an inflammable cargo is ever present. So the main requisite of the electrical system is that it be as safe and rugged as is humanly possible.

The system in general consists of the following: two main d.c., self-ventilated generators, mentioned before, with impregnated windings and non-corrodible fittings. The armature coils are double cotton covered, formed to shape, dipped in varnish and wrapped with pasted mica over the full length of the slots. Sufficient soldered wire bindings are used to assure coils from being displaced under severe operating conditions.



ENGINE ROOM on a tanker contains a compact mass of equipment. Here are shown the high and low pressure turbines in the foreground with the generators and switchboard in the background. Operating platform and gauge board are on the right.

ELECTRICAL PARTS STOCK

Spare Parts for Forced Fan Drafts

- 1—fan rotor complete with shaft
- 1—complete set of bearings

Spare Parts for Rotary and Screw Pumps

(Lubricating oil, bilge pumps, fuel oil service, general service, fuel oil transfer, evaporator feed, fresh water)

- 1—main shaft
- 1—auxiliary shaft
- 1—set bearings
- 1—set packing
- 1—set special wrenches

Spare Parts for Motors each type and Control Panel if more than 3 of one size, spares to be duplicated

- 1—set bearings
- 1—brush holder complete by 3 spare springs
- 1—brush holder insulator
- 1—set brushes
- 1—main field coil
- 1—commutating field coil
- 1—set contacts and spring for control panel
- 1—set resistors for control panel
- 1—set coils for contactors and relays
- 1—spare armature where required in accordance with Classification to include forced draft, fan motors, main circulating pump motor, sanitary pump motor

Tuning gear motor to have in addition to above spares

- 1—set fingers and segments for controller

Lubricating oil purifier will have in addition to above spares

- 1—relay

Spare Parts for Auxiliary Turbine each type and size

- 1—set bearing linings
- 1—set carbon packings with springs
- 1—set springs for governor

Spare parts for Generator each size and type

- 1—brush holder complete with 3 spare springs
- 1—brush holder insulator
- 1—set brushes
- 1—main field coil
- 1—set bearings
- 1—commutating field coil

Spares for Main Switchboard

- 1—bridge carbon for each size circuit breaker
- 1—terminal carbon for each size circuit breaker
- 2—fuses for each size of switch installed
- 5—renewal links for each fuse

The motors on rotary drives are equipped with ball bearings; those on pulley, worm or gear drive, roller bearings; water tight motors, sleeve bearings. The cargo pumps when situated amidship are generally steam driven. Where motor driven, the motors are located in a compartment entirely separated from the pump rooms and cargo tanks. Motors are used to drive pumps for lubricating and fuel oil, bilge pumps, fire pumps, fresh water and evaporator feed pumps, forced draft fans, steering gear and general service.

Electric power on a tanker is distributed in the engine room at 240 volts d.c. and serves the various pump and auxiliary motors as well as electric cooking facilities. The power is distributed from the main generator buses through air circuit breakers on the switchboard. All power distribution circuits 200 amperes and under are controlled from the board by open type fused knife switches. Circuits over 200 amperes have air circuit breakers. In smaller vessels, such as coastwise and river towboats, storage batteries are arranged to automatically pick up the load when the generator is taken off the buses. A motor-generator panel and distribution panel for the 120 volt lighting service is also included.

The electric cargo pump load averages close to 600 hp. with from 3 to 6 pump motors ranging from 50 to 200 hp. in size. The remainder of the load averages from 100 to 150 kw. including 40 to 60 kw. for crew accommodations. Of this the lighting load is 6 to 10 kw.

The lighting on a tanker is served by a motor-generator set which transforms the current from 240 volt d.c. to 120 volt d.c. Since the hull of the ship

cannot carry current at any time, a two wire ungrounded lighting distribution system is used. Two pole switches are used on all lighting control circuits. Guarded gas-tight and weather-tight fixtures are used in the engine room and all other places exposed to moisture and the weather. Four of the engine room lights are connected directly to the generator bus for emergency use.

Lighting other than that in crew quarters includes pump room lighting, which is accomplished by using water-tight swimming pool fixtures mounted behind glass covered port holes in the walls of the pump room areas and controlled by switches outside the room. The deck is lighted by 200 watt gas-tight reflectors mounted on the king posts and on the main and fore masts. These units are controlled by weather-tight switches mounted in cast brass boxes at the base of the mast. Standard equipment for the tanker also includes a number of explosion proof hand portables and explosion proof cargo reflectors, each with 50 feet of cable and locking type attachment plugs. All housings are brass. No fixtures or wiring are permitted in the cargo tanks. Marine type flashlights are used when light is necessary to inspect these areas.

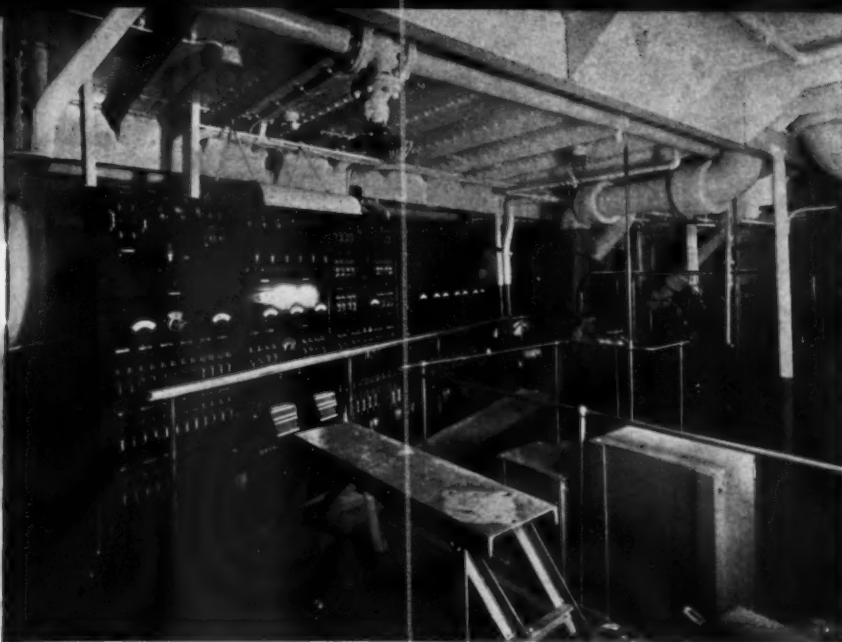
Crew Accommodations

Officers and crew quarters are equipped with non water-tight, cast brass dome ceiling fixtures, wall-switch controlled; bracket light with key socket over the desk, duplex receptacle and radio outlet and a pullman type berth light in each berth, all with brass housings. All pantries are provided with outlets for electric percolators.

The intercommunication system on a tanker includes a general alarm system, operated by a contactor in the pilot house, with alarm stations in all sleeping accommodations. A separate alarm system for the refrigerator room is also installed. A system of electric call bells in the pantry is operated by push button stations in the captain's state room, wheel house and saloon.

The installation of electric cables on the fore and aft gangway has always been a problem in tanker design, both from the standpoint of mechanical protection, moisture and corrosion. Lead

Electrical Contracting, June 1940



TYPICAL TANKER SWITCHBOARD includes panels for storage battery, turbo-generators, motor-generator for lighting, lights and power distribution panels. Note how all outlets and cable are mounted with a one-inch clearance from the steel structure.

covered, armored cable is the standard for oil tanker work. Where the cable is exposed to the corrosive salt water and air, brass basket weave armor is used. Where exposed to mechanical abuse, brass conduit is used.

Another popular method is to install the lead cables in a steel channel under the gangway with a wood or steel cover plate covering the channel. Where multi-conductor cable is used a number of spare conductors for emergency are usually included. No splices are permitted, so if one conductor fails, that leg of the circuit is switched over to one of the spares and service continues. Particular caution is exercised to allow for the expansion and contraction of the vessel. Sufficient cable loops are provided for this purpose. All conductor sizes are calculated for a maximum voltage drop of between 1 and 2 per cent. Lead sheathed cables without conduit are used throughout the ship, except in the crew accommodations where standard navy cable is used

in galvanized conduit. The lead sheath of the cable is grounded to the steel hull at frequent points. All conduit and cable are mounted on steel brackets which provide a one-inch clearance between the cable or conduit and the steel hull. This is done to prevent corrosion due to water and dirt being pocketed between the hull and the cable. All wiring is installed in accordance with the requirements of the Ship Classification Societies for vessels carrying petroleum in bulk, and the latest marine rules and regulations of the A.I.E.E.

Maintenance of the ship's electrical system is relatively simple. Each crew member is trained to keep a weather-eye open for electrical trouble. A delicate ground detector on the main switchboard warns the engineer when a ground develops and immediate steps are taken to clear it up. Each vessel is equipped with a machine shop including a 24-inch lathe; a 20-inch back geared upright power drill; a 16-inch heavy duty extension base shaper and

a double grinding machine all motor driven; vise benches with 6-inch combination machinists vises for engine room, deck, work-shop and pump room; pipe vises, one for 4-inch and one for 2-inch pipe; large, medium and small ratchet drill complete with drills and sockets. The electrical tools include a one pound electric soldering iron, insulated cutting pliers, screw drivers, testing magneto, portable d.c. ammeter and a double scale d.c. voltmeter; a reasonable quantity of string, solder, rubber and friction tape, cable straps, soldering paste, lugs and other accessories.

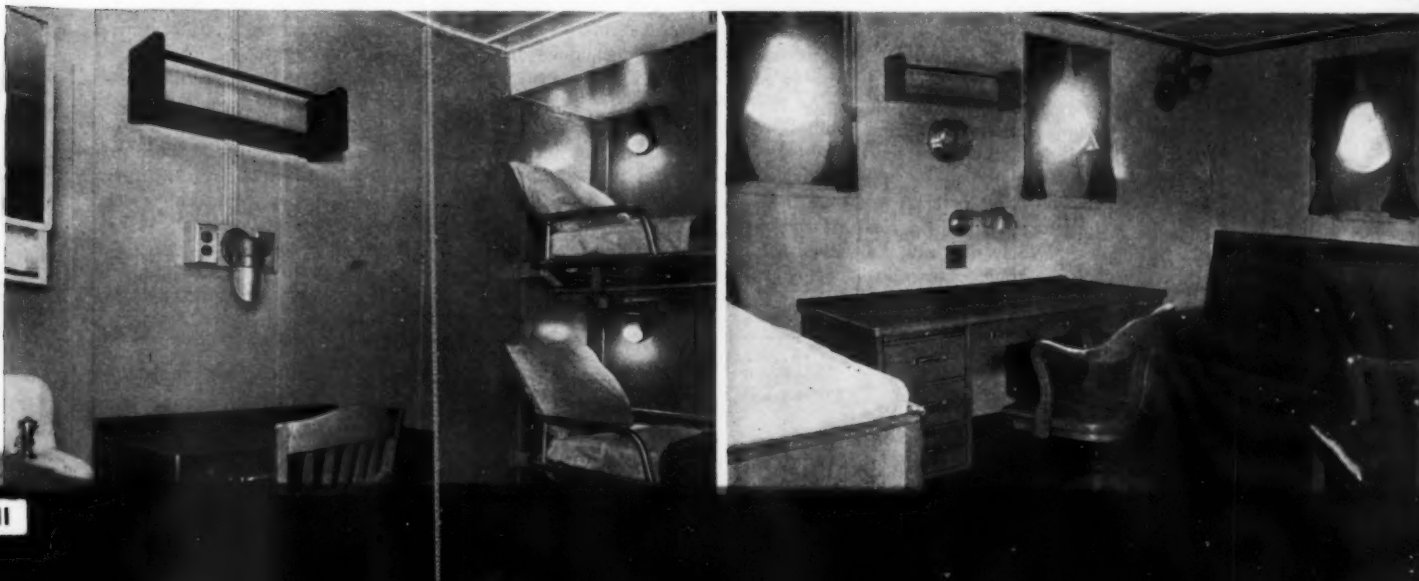
Temporary repairs on insulation breakdown on commutators, motor coils and other parts of the system are made with plastic mica, which keeps the equipment in operation until port is reached and major repairs can be made. The importance of spare parts for electrical maintenance is shown by the large number carried for both motors and controls to make quick replacements.

Here, on a ship is an electrical system complete from generator to outlet. A mobile unit operating under a most complex set of atmospheric and hazardous conditions. Safety and continuous operation demand that everything be of the highest type of mechanical construction and safe design.

Although the average electrical contractor may never be called on to wire a ship, there are many construction and installation ideas that can be applied as a solution to some of the more complex problems he must solve in his own business, both in the industrial and commercial fields of electrical construction.

COMFORTABLE QUARTERS are provided for the crew. Included are a desk lamp, convenience outlet, radio outlet and berth lights. Circuits are run exposed in galvanized conduit.

OFFICERS STATEROOM is a combination office and sleeping room, well lighted by port holes. Concealed wiring feeds the receptacle, fan outlet and lighting outlets.



Time Study of MOTOR REPAIRS

By F. R. Hannon

*Hannon Electric Co.
Canton, Ohio*

The physical dimension method of pricing motor repair work, originally introduced by George P. Svendsen, Boustead Electric & Manufacturing Company of Minneapolis has been widely adopted by the industry. Mr. Hannon presents here a labor hour time study on the same method of classification. Abstracted from a paper presented by Mr. Hannon before the recent NISA Convention in Detroit.

WE have had in mind for some time analyzing labor cost on the basis of unit operations which would permit us to estimate the labor required for repairing and re-winding electric motors. Under the old methods of classifying motors we found it impractical to properly designate the various operations without establishing so many units that we would not be able to collect the proper information from our own records. Since the publication of George Svendsen's classification of motors on the basis of physical dimensions we immediately began keeping records of our labor on the D'L method.

The D'L method of listing reduces price schedules to 26 basic prices for thousands of ratings with the shaft and bearing work still further reduced to about 16 price groups. Motor classifications, instead of the customary horsepower and speed rating, are determined by the air gap diameter, squared, times the core length, or D'L.

Just as this method of classification simplifies the pricing of rewind jobs it also makes possible time studies over enough comparable jobs to produce reasonably accurate labor units.

For collecting time study material we use job cards in connection with a job clock. The job card shows the time the operation began, the time it was finished, the number of the job and a letter which indicates the operation per-

formed. Each day the time is recorded from these cards and is entered on the back of the job sheet which is ruled in columns headed with the name of the operation and the index letter. When the job is completed, these columns are added and the totals are transferred to a cost and motor winding data card. From these cards we post our motor repair labor schedule.

It will be noted that there are some spaces unfilled in the accompanying table. We have not yet worked out the labor hours for all of the stator and motor operations, because many of the larger machines that come to our shop do not correspond with frame number used on the D'L price sheets. Furthermore, some of these machines have form wound coils and if we properly show the labor for these larger machines, we will have to separate the time to show what part was used for making coils and what part for installing and connecting the coils in the stator. Up to the present, we have not advanced far enough in our study to complete this information.

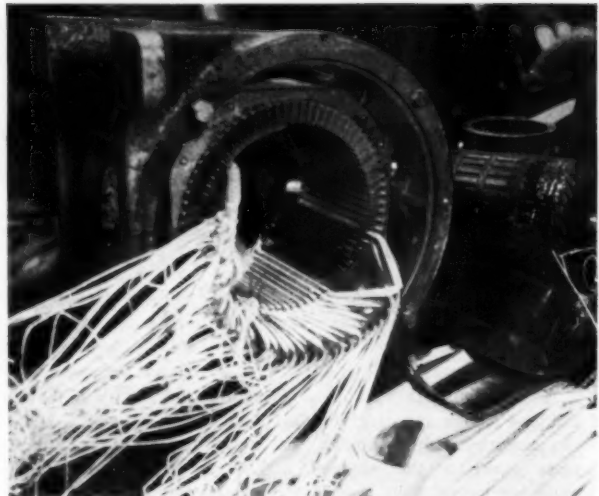
We have found from experience that the labor units vary considerably with

the various types and manufacture of motors. However, the labor units shown are those which apply to NEMA frames only. It was thought to be good practice to list these as standard and consider all other frames as special and subject to an additional 20 per cent increase in labor.

In the accompanying table the column headings are the same as used in Mr. Svendsen's original motor repair price schedule. The column numbers not included in the sequence of 1 to 21 were dimension data figures which are omitted here to simplify the tabulation.

Ordinary variations from the table are as follows: stators and rotors— $\frac{1}{2}$ the fixed charge; gear head and vertical motors— $1\frac{1}{2}$ times the fixed charge; totally enclosed fan cooled motors—2 times the fixed charge; two pole stators the same as four pole; 2300 volt motors—add 30 hours; two to four speed motors—add 60 per cent; one to two speed motors—add 5 per cent and special frames add 20 per cent.

It is our hope that these figures will provide a basis for extended study of labor costs on this classification throughout the industry.



MOTOR REPAIR LABOR UNITS IN LABOR HOURS

For 110 to 550 volts — 2 and 3 phase — 60 cycle motors

		Fixed Charge	Stator	Rotor	Weld Rotor	Reconnect Voltage	Reconnect Phase	Standard Bearing	Under Size Bearing	Ball Bearing	Weld. & Mech. Shaft	New Shaft	Std. Shaft Extension	Each Add'l 3" of Shaft
D ² L	Frame	6	7	8	9	10	11	15	16	17	18	19	20	21
25	A		8.00	9.00	1.00	1.50	2.00							
35	B		9.00	10.50	1.00	1.50	2.00							
45	C		9.50	11.00	1.50	1.50	2.00							
60	D		10.00	11.50	1.50	1.50	2.00							
75	E	1.00	11.00	12.50	2.00	1.50	2.00							
100	F	1.50	12.50	14.00	2.00	1.50	2.00							
125	G	1.50	13.50	15.00	2.50	1.50	2.00							
150	H	2.00	16.50	19.00	3.00	2.00	3.00							
200	I	2.00	19.00	21.50	3.00	2.00	3.00							
260	J	2.50	22.50	25.50	3.50	2.00	4.00	1.50	2.00	1.50	2.50	11.00	6.00	1.00
345	K	3.00	28.00	35.00	4.00	2.50	4.00	2.00	2.50	2.00	2.50	12.00	6.00	1.00
440	L	3.50	31.00		5.00	2.50	4.00	2.00	2.50	2.00	3.50	14.00	6.50	1.00
500	M	3.50	35.00		5.00	2.50	4.00	2.50	3.25	2.50	4.00	15.00	6.50	1.00
640	N	4.00	37.00		5.50	3.50	5.50	2.50	3.25	2.50	4.00	17.00	7.50	2.00
770	O	4.50	40.00	45.00	6.00	3.50	5.50	3.50	4.50	3.50	4.00	18.00	7.50	2.00
960	P	5.00	41.00		6.00	3.50	5.50	3.50	4.50	3.50	5.50	22.00	8.00	2.00
1,170	Q	6.00			7.00	3.50	7.00	4.50	5.75	4.50	5.50	24.00	8.00	2.00
1,400	R	7.00			8.00	5.00	7.00	4.50	5.75	4.50	6.50	29.00	9.00	2.00
1,690	S	8.00			10.00	5.00	7.00	6.00	8.00	6.00	7.50	37.00	9.50	2.00
2,060	T	9.00	60.00		11.00	7.50	11.00	6.00	8.00	6.00	7.50	35.00	9.50	2.00
2,615	U	10.00			12.00	7.50	11.00	7.00	9.00	7.00	10.00	42.00	10.50	3.00
3,000	V	11.00			14.00	7.50	11.00	7.00	9.00	7.00	10.00	45.00	10.50	3.00
3,800	W	12.50			15.00	10.00	14.00	8.00	10.50	8.00	13.00	50.00	10.50	3.00
4,850	X	14.50			18.00	10.00	14.00	8.00	10.50	8.00	13.00	55.00	12.00	4.00
5,720	Y	16.50			20.00	12.50	17.00	8.00	10.50	8.00	13.00	57.00	12.00	4.00
7,500	Z	19.00			22.00	12.50	17.00	9.00	12.00	12.00	16.00	75.00	15.00	5.00

Stators and Rotors 1/2 fixed charge. Gear head and vertical motors 1 1/2 times charge. Totally enclosed fan cooled motors 2 times charge. Two pole stators same as four pole. 2,300 volts add 30 hrs. 2 to 4 speed add 60%. 1 to 2 speed add 5%. Special frames add 20%.

FRAME SIZES FOR 40°C. CONTINUOUS OPEN RATINGS, 110 TO 550 VOLTS, 2 AND 3 PHASE, 60 CYCLES

Syn. R.P.M.	HORSE POWER																									
	1/6	1/4	1/3	1/2	3/4	1	1 1/2	2	3	5	7 1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	250	300
3,600				A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1,800			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1,200		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
900	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
720	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
600	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		
514	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z			
450	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z				

Classified on basis of physical dimensions — (airgap diameter)² x (core length)

FLUORESCENT Drafting R

Third in a series of articles on fluorescent lighting design, application and installation. This article uses three drafting rooms as the basis for case studies of practical application methods.

WITH the close approach to daylight and practical high illumination intensities provided by fluorescent lighting installations it is altogether natural that its introduction into industrial plants often starts in the drafting room. Draftsmen usually prefer a daylight location near the window that gives from 100 to 300 foot candles of lighting on a fair day. The difficult and exacting seeing task that a draftsman performs demands illumination intensities from the lighting system of 50 foot candles and upward over relatively large areas.

To provide 50 foot candles of general illumination with indirect incandescent lighting equipment may require equipment which dissipates energy in the order of 10 watts per sq.ft., producing an uncomfortable quantity of radiant heat. As a rough rule, the upper energy limits for drafting rooms which are not air conditioned is about 5 watts per sq.ft.; beyond this the sensible heat from the lighting installation is likely to be objectionable. Thus, for non-air conditioned draftings rooms the limit of incandescent general lighting has been in the order of 25 foot candles, an amount generally recognized as entirely inadequate for work of this nature.

A well designed fluorescent lighting installation can provide approximately 100 foot candles of general illumination on the working plane within the 5 watts per sq.ft. energy range. Thus, with fluorescent equipment now available, intensities up to 100 foot candles can be produced without considerable radiant heat.

In addition to adequate intensity, the drafting room lighting installation must produce a quality of light that will minimize shadows and avoid bright reflection from shiny surfaces. The ideal solution would be lighting from a solid luminous ceiling of low brightness. In



Case Study A, square spacing on 8-ft. 2-in. centers, 8-ft. 1-in. from the floor with RLM standard units gives an intensity of 45 foot-candles on the working plane.

PANEL 1

Case Study A. Airplane factory—Drafting Department
Area—100-ft. by 60-ft.—6,000 sq. ft.

Layout—84 units on 8-ft. 2-in. centers 8-ft. 1-in. above floor, 59-in. above working plane, 13 rows of 7 units each.
(7 units omitted at one corner)

Type of unit—RLM standard, 2-40 watt daylight lamps with high power factor ballast, conduit stem mounting.

Wiring system—Exposed rigid conduit.

Load density—Net lamp load, 1.2 watts per sq. ft.; including ballast approximately 1.33 watts per sq. ft.

Intensity—Average approximately 45 foot candles on working plane.

industrial drafting room installations, however, standard RLM fluorescent units have a sufficiently large area and low brightness to make a good job.

The case studies illustrated here are typical of fluorescent lighting installations in industrial drafting rooms. All are recent, using standard RLM units with high power factor ballasts.

Case study A. The drafting department of a California airplane plant has an installation of 84 units in a 100- by 60-ft. drafting room. The units are spaced on 8-ft. 2-in. centers in both

directions, at a height of 8-ft. 1-in. above the floor or 59-in. above the working plane. With daylight fluorescent lamps the installation produces an average level of 45 foot candles. The units are suspended on conduit stems from an exposed wiring system.

Case study B. Another aircraft manufacturing plant drafting room uses a closer end-to-end spacing of the lighting unit to achieve better distribution. This installation uses a total of 52 RLM standard units with two 40-watt daylight lamps and high power factor bal-

Room LIGHTING



Case Study B, unequal spacing, 7-ft. 2-in. centers endwise and 8-ft. 2-in. between rows at 8-ft. 10-in. above the floor gives 45 foot-candles.

PANEL 2

Case Study B. Airplane factory—Drafting Department
 Area—80-ft. by 36-ft.—2,880 sq. ft.
 Layout—52 units spaced 8-ft. 2-in. by 7-ft. 2-in. centers, 66-in. above working area, 10 rows of 5 each (2 additional units used).
 Type of unit—RLM standard, 2-40 watt daylight lamps with high power factor ballast, conduit stem mounting.
 Wiring system—Exposed rigid conduit (some concealed wiring in suspended ceiling at one end of drafting room).
 Load density—Net lamp load, 1.36 watts per sq. ft.; including ballast approximately 1.5 watts per sq. ft.
 Intensity—Average approximately 45 foot-candles on working plane.



Case Study C, close end to end spacing 6-ft. centers endwise, 7-ft. 2-in. between rows and 8-ft. 3-in. above the floor gives 60 foot-candles on the boards.

PANEL 3

Case Study C. Power plant equipment mfr.—Drafting Dept.
 Area—36-ft. by 65-ft.—2,340 sq. ft.
 Layout—2 groups of units. Each group has 9 rows of 3 units on 6-ft. by 7-ft. 3-in. centers, 8-ft. 3-in. above the floor.
 Type of units—RLM standard, 2-40 watt daylight with high power factor ballast, chain suspension.
 Wiring system—Concealed, one outlet at end of each row, units wired end to end through wiring space in hood and short jumpers.
 Load density—Net lamp load, 1.84 watts per sq. ft.; including ballast approximately 2.02 watts per sq. ft.
 Intensity—50 to 60 foot-candles on boards.

lasts in each. The general layout pattern is 10 rows of five units in each row. The rows are spaced 8-ft. 2-in. apart and the units spaced 7-ft. 2-in. between centers in each row. They are hung 66-in. above the tables, or 8-ft. 10-in. above the floor.

The wiring system is exposed in rigid conduit, except in one bay at the end of the drafting room where the wiring is concealed in a suspended ceiling. The units are conduit suspended.

Here, also, the resulting intensity in foot-candles is approximately 45.

Case study C. A power plant equipment manufacturer's main drafting room is 65-ft. long and 36-ft. wide, with a central aisle, and with offices at the front end and reference tables along the back wall. The lighting units are arranged in two groups, 9 rows of 3 units in each group. The units in each row are spaced on 6-ft. centers, practically end to end, and the rows are spaced 7-ft. 3-in. apart. The units are mounted 8-ft. 3-in. above the floor.

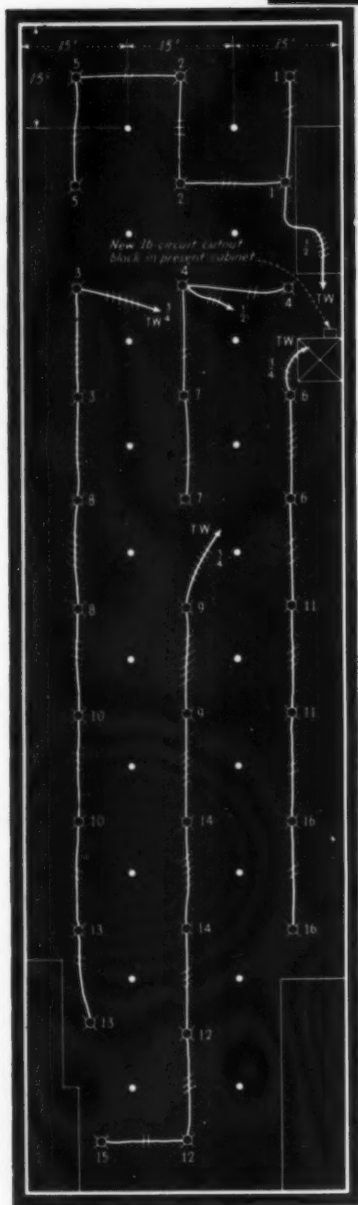
Over the drafting tables RLM standard units with two 40-watt daylight

lamps and high power factor ballasts are used. At the end of the room over the reference tables are single lamp reflectors with 40-watt daylight lamps.

The wiring system is concealed, terminating in an outlet at the end of each row of three reflectors. The reflectors are suspended from chains and each row of three is wired together through the wiring space in the hood with short flexible jumpers between the units. In this installation the intensities vary from 50 to 60 foot-candles on the drawing board with 40 in the aisle.

BEFORE REWIRING

original wiring system had been capped and lighting provided by concealed column cove illumination.



NEW WIRE adds

How 1,500 feet of small diameter wire made possible a job that ran close to \$1,500 in business for a Chicago contractor. Another case study of how contractors are using small diameter wires to open up new business.

JOHN A. Colby & Son is a progressive furniture house in Chicago's famous central loop district. The building, like many of its neighbors, has been suffering from tight wires. Inadequate electrical wiring and inadequate lighting were perpetuated by a 30-year-old wiring system buried in the building construction. In the ensuing years the original wiring system had been abandoned and new circuits run to the building columns to feed a new concealed cove lighting installation.

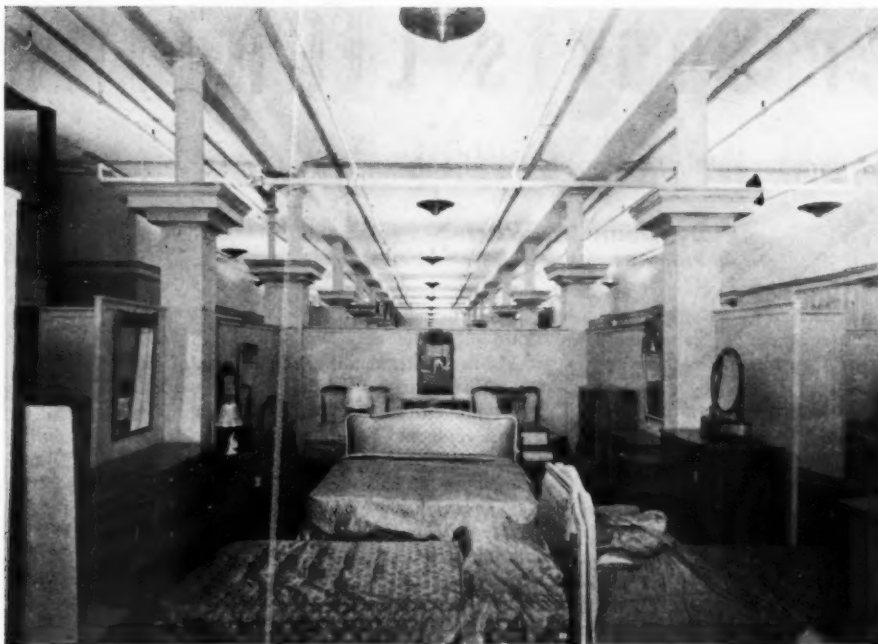
In time, the cove lighting installation became obsolete with the rapidly expanding high level illumination stand-

ards demanded by modern merchandising. The most important factor in relighting the second floor showroom was not so much the cost of replacing the existing conduits as the losses the store would incur during the extensive remodeling and redecorating that would be necessary.

The Industrial Electric Company of Chicago tackled the job. With the co-operation of utility lighting engineers and Dave Talbot, acting chief inspector of the Chicago Electrical Inspection Department, a plan was worked out employing the original branch circuit conduit and using small diameter wires wherever the conduit area was too small to pull in adequate copper in the conventional type R wire sizes.

The original floor layout had 30 ceiling outlets on 15 foot centers in three rows, with six to eight outlets on a

CIRCUIT LAYOUT employing small diameter conductors in existing conduits. Cross lines indicate the number of wires. For more than two circuits in a conduit small diameter wires were used, for two or less, standard type R conductors were used.



AFTER REWIRING

the column coves were abandoned and new 750 watt indirect units installed on original outlet using original conduit

NEW BUSINESS

By

W. T. Stuart

circuit. There were five home runs, three of which were 4-in. The revised layout placed two outlets on each circuit, using No. 12 type R wire for that part of the conduit system carrying one or two circuits and No. 12 small diameter Laytex conductors for the rest of the conduit system and the home runs.

An old link fuse cut-out block was replaced with a new 16 circuit panelboard in the existing cabinet. The cove lighting installation was abandoned and new 750 watt full indirect lighting units installed on the rewired outlets.

The existing feeder from the basement was reconnected to the new panel. A new d.c. service of three 900,000 circular mil conductors, a 600 ampere main, with five branches consisting of one 400 ampere, three 100 ampere and one 30 ampere circuits were installed. A new subfeeder of three 500,000 circular mil conductors was run to the building lighting feeder.

In addition to the work directly associated with the new lighting system, 24 new plug receptacles and 39 feet of new plug-in strip were installed at various points in the building.

Estimator L. T. Brown of the Indus-

trial Electric Company reported that the installation of the new conductors went in without any special preparation and that the labor hour time on the small diameter conductors was approximately the same as for conventional type R building wires. The new conductors were installed without fishing by trailing them in as the old twins were removed. The small diameter wire proved satisfactory for handling on the

job without special precautions against abrasion or injury to the installation.

This job is a striking example of where a comparatively small quantity of small diameter wire effectively used was the key to a sizable job. The conditions surrounding this job are typical of what thousands of building owners all over the country are facing. Similar opportunities are available to electrical contractors everywhere.



ELECTRICAL CONTRACTOR, estimator L. T. Brown and president M. M. Thomson, Jr. worked out a plan to provide modern lighting from the old conduit system with small diameter wire.

Summer Sports LIGHTING

Recommendations for lighting various types of outdoor recreational areas.

By Dean M. Warren

General Electric Co., Nela Park, Cleveland, Ohio

SPORTS games at night are becoming increasingly popular. And there is a growing market here for the electrical contractor. In planning a lighting system for outdoor recreational areas, there are four basic principles to be considered. They are as follows:

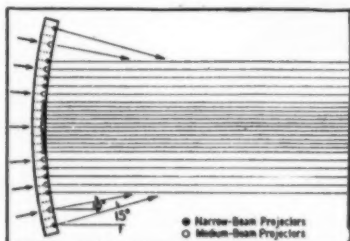
1. Give consideration to type of audience. A large audience requires more light than a small one in order to hold its attention.
2. When lighting games in which only the players are considered, provide more light for skillful ones than less

skillful. This is necessary because the skillful player has to see in greater detail all operations of game.

3. Absence of glare is absolutely essential. Players cannot do their best when being continually blinded and audiences should be protected from objectionable spill.

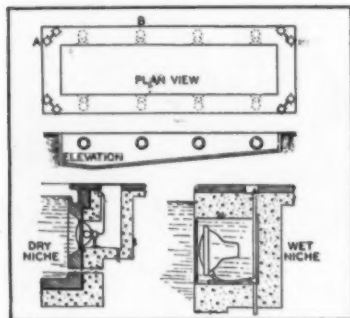
4. Outdoor lighting installations should not be flimsy. Equipment should be sturdy enough to withstand severe weather conditions, including high winds.

Listed below are recommendations, with sketches, for lighting various types of outdoor recreational areas.



GOLF DRIVING RANGE—Types of projectors: (1) High candlepower narrow angle for long drives; (2) Medium angle for short high shots. Location—one projector for each tee with no less than a total of nine projectors for any driving range. About one-fourth of the units should be medium-angle projectors. Mounting height—approximately 15 feet. Lamp size—1000-watt G-40 for narrow-angle projectors, 1000-watt PS-52 for medium angle.

SWIMMING POOL—For surface lighting equipment: Two open-type floodlighting projectors, or two enclosed projectors with heavily stippled clear glass doors. Location—at each corner

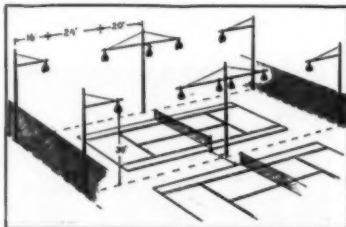


of the pool on 25- to 40-foot poles. Lamp size—1000- or 1500-watt.

For under water lighting. If water is sufficiently clear to see the bottom 10 feet below the surface in daylight, underwater lighting will be satisfactory. Two classes of underwater lighting are:

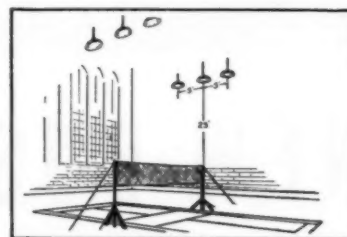
(1) Dry Niche—500-watt projectors with 40 deg. spread lenses, spaced not more than 12 feet apart on each side of pool 1 to 1½ feet below the water level. Manhole to be provided for servicing.

(2) Wet Niche—Same as above except that underwater equipment is necessary. Units are mounted 1 foot to 1½ feet below water level. Front of niche should be protected by bull mesh. Because of the flexible hose and conductor, this type of wet niche unit makes possible cleaning or replacement of lamps without draining pool.



TENNIS (Outdoor)—For single courts: Type of reflector: wide angle, deep bowl aluminum with skirt. Location—mounted 30 feet high on brackets with poles located as shown. Lamp size—1500-watt for recreational play; 2000-watt for championship. A string of five 1500-watt units on messenger cable along the center line of each court.

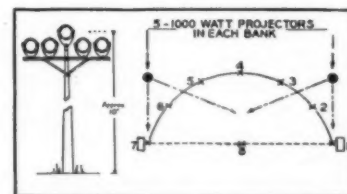
For two or more courts: Layout and specifications same as for single court but the inner rows require six reflectors without the shielding skirts



BADMINTON—Because of the high flight of the bird, the lighting arrangement must avoid over-bright light sources in the players' eyes while looking upwards. Uneven levels of illumination will cause the bird to appear to hop or change speed in flight.

Indoor: Type of unit: 24-inch Glassteel. Location—three units, 25 feet high, at each end of net. Lamp size—750-watt. Footcandles recommended—25.

Outdoor: Type of reflector: two-socket open-type matte porcelain enamel. Location—one reflector at each end of net on 25-foot poles. Lamp size—750- or 1000-watt inside frosted. Footcandles recommended—25.



SKEET—In skeet, the flight of the clay pigeons is intended to duplicate the angles of flight found in actual wing shooting. Floodlighting projector beams

(Continued on Page 55)



By W. B. Nelson

President, Telephone Engineering Co.
Low Tension Maintenance Contractors
New York, N. Y.

FOR the past 14 years I have been actively engaged in the installation of all types of communicating equipment including the magneto, common battery, dial and intercommunicating types. Whenever anything goes wrong with a customer's communication system, we are called in.

During my experience in this field, I have discovered that the major causes of failures are; the practice of having handy-men make repairs; the apparent negligence of owners to replace worn and defective parts and in some cases poor original installations.

The first cause can be remedied only by securing an experienced man to do the work. This is frequently difficult if it takes from three to five years to adequately train a man to properly understand the operation of these systems.

The second cause can be cured by showing the owner that it is to his advantage to protect his investment in the low tension systems in his buildings. For a system that operates improperly costs more in the end through lost time and inconvenience.

The third problem can be remedied by having a definite set of plans and specifications for each system. These plans should specifically state the number and size of conductors, the type of terminal boxes and strips, and above all, good quality standard equipment. On old installations where these points have been neglected, they eventually have to be remedied in the ensuing maintenance that will be necessary.

Another important policy is to keep all systems standard by using the same equipment manufacturer's parts.

Some of the more common causes of trouble discovered in our maintenance work and the precautions taken to

remedy these causes are listed below.

Apartment house telephone failure often develops when watchcase receivers and cords are replaced. These systems do not employ induction coils in their circuits and the direct current is across both the transmitter and receiver. Permanent magnets are employed in most receivers. Improper connections on the receiver will allow the direct current to flow through its coils in the wrong direction, demagnetizing it and making it inoperative. If the shop cannot remagnetize these magnets they must be returned to the manufacturers for repairs or be replaced.

Attempts are often made to clear trouble on these systems by increasing the talking voltage above that specified by the manufacturer. If this is done the transmitter carbons will burn, frying sounds will appear and eventually the transmitter will fail.

Increasing the voltage on the ringing circuit is equally destructive since it burns out the push button contacts, bells or buzzers. In the case of the series circuit lamp switchboards, the lamps, relay and buzzer burn out.

A common error is to try to correct low wattage by increasing the voltage. This may work where there is only one unit on the circuit. Where a common source of current supply is used for the operation of a number of units, considerable damage can be done to the equipment near the source of supply. The real trouble is due to lack of wattage and can be remedied only by providing enough to operate the units.

Low voltage at any given unit is another source of considerable trouble. This is caused by that old bugaboo "voltage drop" and can be corrected by installing circuit feeders of sufficient size to provide operating voltage at the most remote unit.

Bells and buzzers assembled on metal frames using the frame for one contact should be mounted on wood back-

SYSTEMATIC CLEANING and dressing of the contacts on this 200 line automatic intercommunicating telephone board assures uninterrupted service for its 5000 daily calls

Problems of LOW TENSION MAINTENANCE

New York contractor maintains low tension signal and intercommunicating systems. He tells of some problems he encounters and their solution.

boards to insulate them from all conduits, metal lath and steel work. In one particular case lack of this precaution caused three apartment bells to ring when either button was pushed.

On equipment employing relays, dirty contact points are frequently a cause of serious trouble. The gummy film that forms on the contacts and armatures can be easily and safely cleaned with carbon tetrachloride. These contacts should never be cleaned with nail files, sandpaper or emery cloth, but should be polished with a burnishing tool. If the contacts are pitted an ignition file should be used to remove the pits before burnishing. Contact springs should be adjusted only with spring benders, never with pliers.

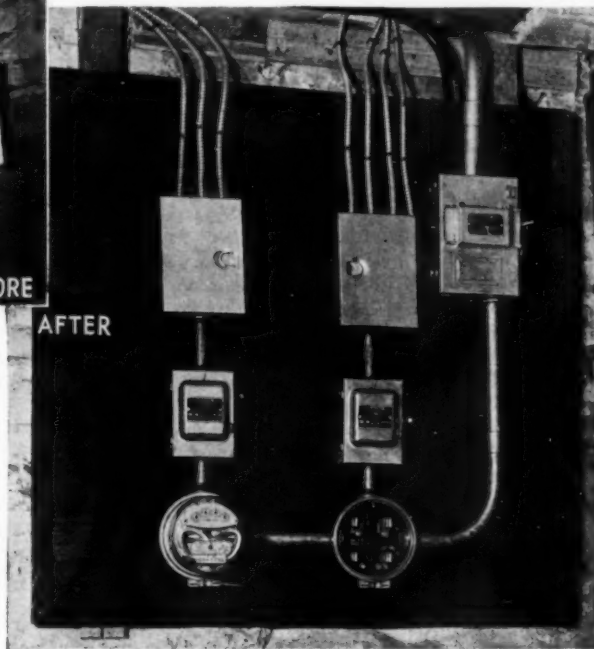
In general, low tension systems will operate satisfactorily for an indefinite period if properly maintained. Since this is a large part of our business we have found that "the proof of the pudding is in the eating," for all our customers have told us how much more they gain in service and convenience through regular maintenance.





BEFORE

BEFORE AND AFTER pictures like those shown help to sell future jobs. It is much easier to convince a customer to clean up his service if he can actually see what a difference the change will make. "Seeing is believing"—works equally well in the contracting business.



AFTER

Don't Miss Those Extra Dollars

A contractor explains how extra minutes on every job uncover new opportunities and pay big dividends

By Harold P. Strand

Electrical Contractor, Somerville, Mass.

THE average electrical contractor is often lax in taking advantage of opportunities that are to be found on every-day jobs. Upon getting a call to see about wiring some base outlets or switches, he looks over the job, organizes material and men for the work desired, then hurries off to look up the next job on the list. But while it is important to cover all calls, a few minutes of checking around will pay big dividends in increased work for the shop.

Take a good look at the meter board and service entrance. If it is in poor condition or inadequate for the load, there is a good chance for selling new wiring and equipment. How are the fixtures? A fixture catalog carried handy in the car will often sell a complete set with a little judicious sales talk. Faded and tarnished fixtures of

old style can ruin an otherwise immaculate room. Then too, many wiring systems have been added to so much that they have become a confusing mixture of different types of wiring.

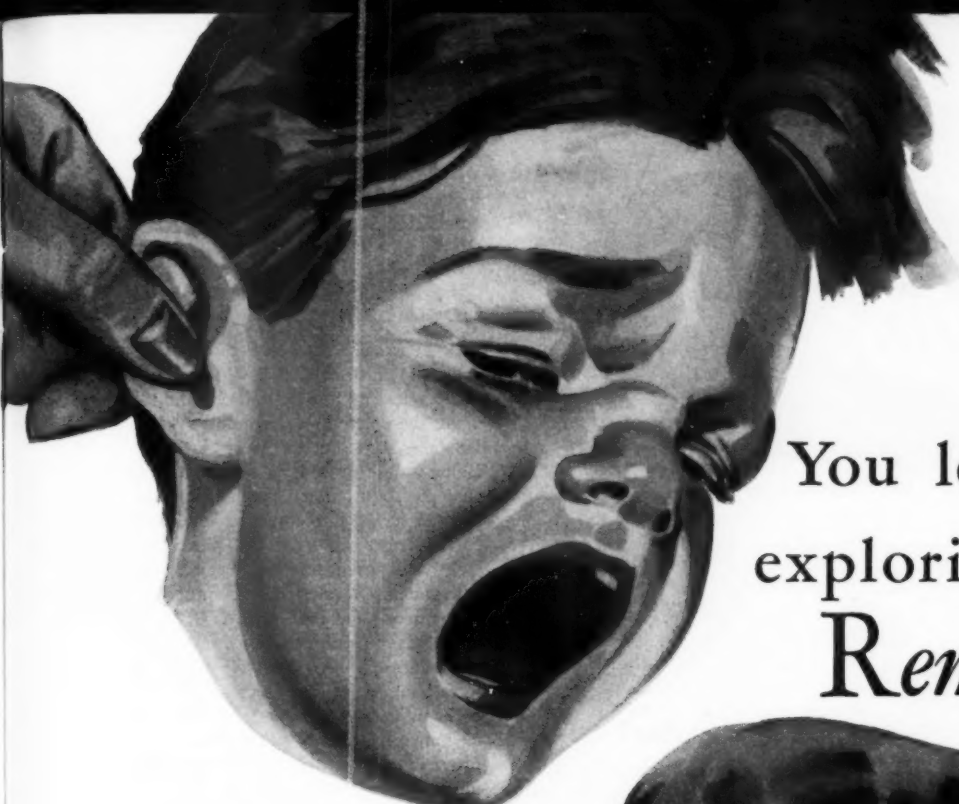
They ought to be fixed up. The accompanying before and after photographs cover just such a job. It presented all the foregoing faults and when the owner ordered some additional wiring, the contractor informed him that to add further to such a system would be exceedingly risky. As a result—a complete wiring job with new fixtures was sold. The original amount of work ordered by the customer would have been around fifty dollars. The contract however was written up for over three hundred!

Of course in such cases a certain amount of tact and diplomacy must be employed. The danger of defective wiring is the first and best argument to put up. Then comes the added convenience and improved appearance that modern wiring and fixtures provide.

Usually assistance can be obtained from the city inspection department. For, as a rule, the inspector is heartily in accord with condemning unsafe wiring in any building. In the case illustrated, he was consulted before any work was done and was requested to look the house over. It took but a short time to size up conditions and the inspector supported the contractor's advice that the house must be re-wired, if any further alterations or additions were to be made.

There are probably similar cases of antiquated wiring systems in everyone's territory. The electrical contractor who is looking for opportunities to enlarge his sales, should point out questionable conditions in the customer's wiring system. The owner usually is not aware of the existing danger and is glad to have a safe home to live in, if possible.

Defective wiring can be found in abundance in rented property. Tenants will often attempt their own wiring with tacked cords, amateur base outlets and what not—unknown to the landlord. This condition is hard to combat. But when a tenant moves out, and you are called in for any purpose, the attention of the landlord can be called to the necessity for removing and replacing such shoddy work. And replacing obsolete wiring offers new business.



You learned this
exploring the attic
Remember?



IT was years ago when you scrambled up onto old dirty trunks and lifted off the dust-laden lids of curious old boxes . . . remember? And remember your hands, and that clean new white suit . . . and what your good mother had to say about the dust and dirt that lays like a blanket where little boys are not supposed to go?

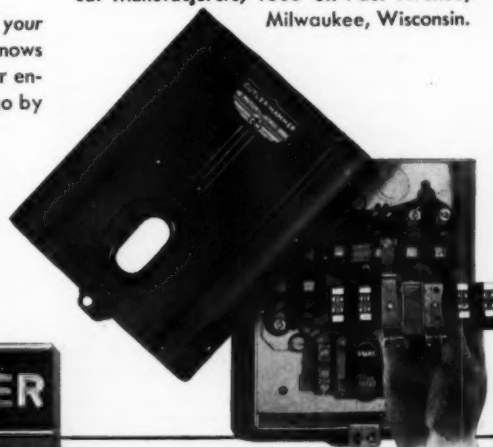
Well, little boys are not supposed to go inside the Motor Control in your factory today. In fact, your Motor Control should be so good that even those big boys who work with screwdrivers and pliers are supposed to pass that Motor Control by for months at a time without ever putting a

finger inside it. And just as your mother said, there you will find a blanket of dust . . . dust and dirt in a layer on every horizontal surface.

Now that is very bad if the contacts in your Motor Control are horizontal, for everyone knows dirty contacts mean trouble. Cutler-Hammer engineers solved that problem a long time ago by designing *their* contacts to stand *vertical* so they can't collect dirt, so they *must* stay clean to work better and *last* longer. Cutler-Hammer is the *one* Motor Control that uses *vertical* contacts exclusively.

Don't you think you too should specify Cutler-Hammer and protect your Motor

Control investment with good common sense?
CUTLER-HAMMER, Inc., Pioneer Electrical Manufacturers, 1306 St. Paul Avenue, Milwaukee, Wisconsin.



Insist on

Dust Safe VERTICAL Contacts

Editorials

Good Wiring Pays

William Wachter of the Wachter Electric Co. in Kansas City told us of a striking example of the effect of adequate wiring on lighting. The offices of a local concern were rewired in preparation for a new lighting installation. The old conductors were removed and small diameter conductors pulled in the existing conduits with each outlet on a separate circuit.

Awaiting a decision on the new lighting fixtures the old lighting equipment and old lamps were replaced temporarily. With the new wiring system the average lighting intensity showed an increase of 22 per cent.

The effect of voltage loss in obsolete wiring systems is a point that is not easy to get over to our customers. With a little foresight we can make a direct comparison like this on many of our jobs. And, it tells the story better than any formula or chart.

Re-Inspection And Small Diameter Wire

The coming of small diameter building wire gives the electrical industry another string to its bow when it calls for more intensive re-inspection of old wiring. In the past there has been almost no alternative to leaving old wiring in service until it reached a really dangerous stage, because to do otherwise would have seriously penalized the owners of commercial buildings.

Now that this work can be done simply, inexpensively and with almost no discomfort to the occupants of buildings, electrical inspection departments have more justification than ever for setting high standards for building wiring systems. Perhaps this, in time, will mean that higher inspection fees must be charged in order

to pay the salaries of the additional inspectors that will be needed, but those fees in the long run will benefit both the general public and everyone concerned with the electrical business.

Who's A Chiseller?

Probably one of the favorite complaints made about electrical contractors is that they are out to buy at the lowest possible price. We don't think that should be a subject for complaint. Every electrical manufacturer, every utility and every wholesaler that we know anything about has a purchasing agent. The principal job of a purchasing agent is to get the best possible price.

Then why criticize the contractor if he tries to do exactly what everyone else in the industry does as a matter of course? We'll grant that there is one basic difference between the contractor and the manufacturer, for example. Most manufacturers are set up so that they can establish fairly exact specifications for the products they buy, and if they have made a purchase they are able to test the material upon delivery to see if it meets those specifications.

Naturally no contractor can afford to set up his own research laboratory, so when he buys he must rely to a very great extent upon the claims made by manufacturers. If he buys the wrong thing, isn't there a good chance that manufacturers of the better types of products have failed somewhere along the line to tell about quality, or service, or some other sales factor that would have made a great deal of difference to him if he had known about it?

Without trying to tell manufacturers how to run their sales organizations, wouldn't some of them find it worthwhile to build a fund of real performance data, either from their

own research departments or from independent laboratories and give the contractor some tangible proof of quality?

Good Selling

A contractor recently received an order to install 135 base and wall receptacles in a new office building, using the conventional conduit system. No telephone outlets were included. Being sales minded, he called on the customer, sat down with him and painted a word picture of extension cords strung all over the place, unsightly exposed telephone wires, inconveniently located desks, future inconvenience and inadequacy. Then he made his recommendations.

The result: An "extra" order to install an underfloor duct system for both light and telephone. Now the customer has plenty of adequacy with provision for 475 receptacles and telephone outlets each and ample room for the easy installation of the extra circuits.

Nice work Mr. Contractor. That's the type of selling our industry needs and plenty of it. Besides providing a nice slice of "plus" business, it raises the standards of wiring and adequacy. And what's more—the customer will thank you for it.

Heaven knows we can use salesmanship. Let's have more of it.

Low Voltage For Portables

The extensive use of portable electrical equipment and portable lamps for industrial production and maintenance is creating some serious shock hazard problems. While a 120 volt jolt from a frayed cord may be a joke to the boys at the bench it can mean death to a man clinging precariously to a roof truss or inspecting machinery in operation.

There is a chance here for electrical contractors and plant maintenance engineers to do some real missionary work in the field of industrial safety. Regular inspection and repair of portable devices, separate grounding conductors and routine insulation tests will go a long way toward cutting accidents that result from electric shock. But there is another method, rapidly becoming standard practice in several large steel plants, that deserves much wider use—reduced voltage on portable equipment.

The equipment is simple; a small insulating transformer, permanently mounted or portable, reduces the lighting circuit voltage to 32 volts. Portable equipment, rated at 32 volts, plugs into the transformer or into special outlets. As the secondary system is ungrounded there is no possibility of shock unless the operator gets across both live terminals. And, at 32 volts, the muscular spasm produced even with a good solid contact may be annoying but not uncontrollable.

It is quite practical to design portable lighting equipment and small power tools for potentials as low as 12 volts. The necessary equipment is not expensive. Safety minded plant management and good wiring can cut shock hazard accidents to zero. But, this industry will have to tell the story.

Selling Fixtures

You can bid yourself right out of business. Many of us have suspected that, but perhaps it doesn't strike home quite so hard as when you see a whole industry or branch of an industry just about walk off the deep end that way. Take the fixture industry for example.

In one section of this land the other night, a bunch of desperate fixture men sat down to dinner at a meeting. Listen to the irony of this. One man admitted to the speaker that he had lost the fixture order on a group of small houses. He had bid \$6 a house, the other guy had cut under him to \$4.50. Incredulous! The speaker asked if he did not mean just one room but was assured his bid was for fixtures for the whole house.

Later it came out that in a tract of 600 new small homes not a single one had installed a ceiling outlet in either living room or bed room. Simply weren't going to use fixtures to get light.

Yet a newspaper ad was spread out announcing that a big department store in town had opened a fixture department. And a big chain store broadside also had ads for fixtures. Cheapest ones offered were \$7.55, and they ran up to \$49.50. Yet on a bid of \$6 for a whole house this man had lost.

Here is a problem that vitally affects our whole industry. We think it's time for united action to keep this business in the hands of electrical people and to sell the idea of quality fixtures and plenty in every home.

Training in Welding

Electrician apprenticeship classes in Detroit have added welding as a part of the regular curriculum. Other schools contemplate adding this course as a part of the basic training of electricians.

The next broad development in wiring system installation technique will probably include extensive use of portable welding equipment. If it is necessary to go outside of the craft for operators, welding in electrical construction will be limited to exceptionally big industrial jobs where a special welder crew can work to advantage.

Skillful use of welding equipment, within the needs of the electrical construction industry, should offer no problem to our own electricians if sound preliminary training is available.

Farm Wiring Code

A report of the Farm Fire Protection Committee at the National Fire Prevention Association annual meeting revealed the startling fact that less than five per cent of the new rural wiring jobs in four southern states comply 100 per cent with the NEC. This is especially alarming in these times when rural wiring is increasing and when we are striving to raise wiring standards for the safety of the consumer.

One method of curbing these substandard installations is to clarify the rules and regulations in the NEC pertaining to rural wiring. A separate section could be organized to incorporate all the rules regulating safe wiring in these areas. This would be of inestimable value to the contractor doing this type of work.

With this as a basis, compulsory inspection could be organized, with qualified inspectors passing on all installations. A proposed state inspection law, now being considered by NFPA is one step in this direction and should receive the industry's support.

An educational program could be launched by the inspectors to acquaint these farm people with the hazards of unsafe electrical wiring. Such programs are now being used to sell the farmers electrical merchandise—why not do the same to sell them safe wiring?

Protection

Comment is already freely made that the wire amperage tables in the new Code will introduce complications into the otherwise calm life of our industry. One problem has been the selection of protective devices—either fuses or circuit breakers—adapted to the ratings given by the new tables. Are we to have devices giving protection at such odd figures at 79 and 81 amperes, for example?

Fortunately, it now seems reasonably sure that there will be sufficient simplification so that there won't have to be many—if any—more rated capacities of protective devices than we have been accustomed to.

Ante If You Want To Win

By the very nature of their business contractors are local minded. Most of them prefer to do business within a few miles of their offices or stores. In spite of this strong local interest, however, some things that are national in scope do have a vital bearing on their business—programs such as that of the National Adequate Wiring Bureau.

We think most contractors want to get all the advantage they can from every such program but all too often a cry is raised that some other section of the industry takes the lead in promoting the program to the public and does things which either do not benefit the contractor or else hurt him. As long as contractors will not join hands and form closely knit groups, city by city or county by county, there is nothing that they can do about this individually. But if they are willing to join or form local contractors' associations and, wherever necessary, put up some real money to promote these national programs in their parts of the country, they will not only have a real voice in what is to be done but will be able to veto anything that seems likely to hurt them.

Money talks, particularly if the money is coming from such an important group in the industry as the contractors, and the other factors in that industry are asking for cooperation. And don't forget that the combined influence of a lot of healthy well-financed local contractors' associations would make itself felt in the preparation of every future national program, regardless of the sponsor.

WE ARE MAKING

This enclosed breaker is being installed for the protection of a branch feeder to pump-motor circuits in the G-E Philadelphia Works

This G-E drawout switch-gear with air circuit breakers protects 440-volt a-c feeders in a G-E factory

Here is a G-E air circuit breaker installed with a 50-kva bench spot-welder in the G-E West Lynn Works

AS LOW AS \$99.98 NET for the G-E Type AE-1A manually operated enclosed air circuit breaker

A group of four G-E air circuit breakers protect the branch feeders to electric furnaces in the G-E Philadelphia Works

G-E air circuit breakers protect the thyatron control and welding machines in the welding section of the G-E Philadelphia Works Laboratory

**Be Sure of Your IC with
G-E Air Circuit Breakers**

SURE OF OUR "IC"

INTERRUPTING CAPACITY

Are You Sure of YOURS?



HERE'S one case where the cobbler's children aren't going barefoot! For more than a year we have been suggesting that you "Beware of mad short circuits" and that you "Be sure of your

IC with G-E air circuit breakers." At the same time, we have been taking our own medicine. Right in the Philadelphia plant where they are made, we have been installing G-E air circuit breakers to protect feeders leading to welding machines, electric furnaces, machines in our wood-working shop—in fact, wherever adequate interrupting capacity is needed to protect personnel and equipment.

Protect Men and Machines

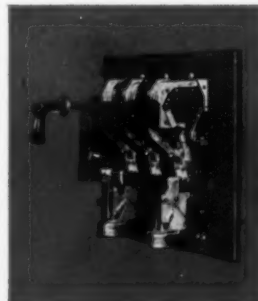
This program is well under way. Already, every resistance welding machine in the Philadelphia Works has been furnished with one of these breakers. And, the same program is being carried

out in other G-E plants. Breakers are being installed to protect men and machines and to help maintain continuous production in our Schenectady, West Lynn, Pittsfield, and other Works. But we aren't the only ones who are recognizing the importance of providing plenty of IC. Operators of all types of industrial plants throughout the country are installing G-E air circuit breakers. Many who have provided this modern form of protection for one machine have already placed repeat orders for breakers to be used with other equipment.

Play Safe with Short Circuits

The severity of a short circuit depends largely on the capacity of the transformers that feed the circuit, and it can *not* be determined by the normal load on the circuit. As plant loads have grown, transformer capacities have been materially increased. Therefore, short circuits present an ever-increasing hazard. They gravely endanger personnel and property wherever the power supply has outgrown the interrupting capacity (IC) of the protective devices.

Are you sure of *your* IC? With G-E air circuit breakers of *known* interrupting capacity, you *can* be sure. If you have any question about how to determine the interrupting capacity needed, in order to know the size of circuit breaker to use, get in touch with the nearest G-E office. General Electric Company, Schenectady, N. Y.



Type AE-1A manually operated breaker with side of arc quencher removed to show pins and contacts



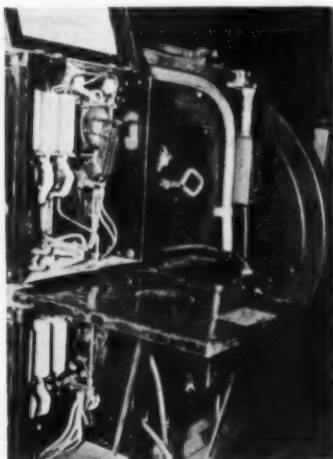
G-E Air Circuit Breakers Are Available with Interrupting Ratings Up to 80,000 Amp

GENERAL ELECTRIC

WIRING Methods

MECHANICAL INTERLOCK

When wiring the control board for a large lathe, which has a 44-inch swing, Electrical Engineering and Service, Inc., of Westfield, Mass., wanted push button reversing control for the 10 h.p. motor. But, since they wanted all control accessible to the operator, the mounting space was limited. And a reversing type magnetic switch for this size motor took up plenty of space.



MECHANICAL INTERLOCK between two magnetic switches solves the magnetic reversing switch problem in this restricted space on a lathe motor control board.

To solve the problem they mounted two standard magnetic switches one directly above the other. One was to operate as the reversing contactor, the other for the forward position. To accomplish this the arms which actuate the contacts on each starter were interlocked with an offset rod passing from one switch through the enclosing cases of each to the other contact arm. One end of the rod was attached to the back of a connecting lever to the contact arm of the top switch, the other end of the rod was connected to the front of a similar lever to the contact arm of the bottom switch. The rods at both ends

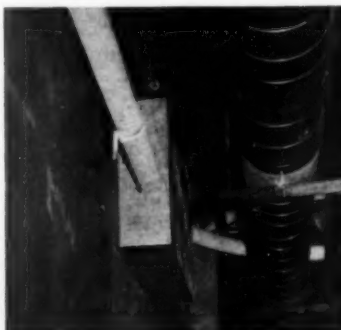
are equipped with stop nuts, so arranged that there is enough leeway to allow one set of contacts to close at a time, but not both simultaneously. So, when the top contacts are closed, the rod holds the bottom ones open and vice versa. This magnetically operated reversing switch was made to fit the space and operation requirements of this shop.

HIGH TENSION CONDUITS

Four long narrow buildings of a public market project in Kansas City, Kansas, have transformer vaults located in the center of each building. Primary lines feeding the transformer vaults are carried in a three inch transite asbestos-cement conduit mounted along the wall of the service tunnel.

As may be noted from the accompanying illustration the transite conduit is installed in a manner similar to rigid steel conduit. Pull boxes provide access to the runs for pulling in wire. The conduit is supported by one-ear clamps to a flat iron saddle which supports it away from the wall.

The installation was made by the W. T. Foley Electric Co. of Kansas City, Kansas, contractor for the substation and primary distribution lines.



ASBESTOS CEMENT conduits carry high tension primary circuits through service corridors.

PYROMETER BUS ON ROTARY KILN

One of the most intricate problems faced by the Pacific Electric Motor Company of Oakland, California, at the West Vaco Chlorine Products Company, Newark plant, was that of conducting pyrometer current from a rotary kiln to stationary apparatus.



ROUND COPPER BUSSES on rotary kiln conduct current from pyrometers to stationary equipment.

This was accomplished by very carefully shaping 1½-inch copper tubing into a smooth circular bus around the kiln. Large copper or bronze rollers were then pressed under tension against these busses. The current from the pyrometers connected to the busses is conducted through the rollers to the stationary equipment.

QUICK MEASUREMENTS

The M. B. Foster Co., Boston electrical contractors, have set up in their field shop a measuring system that definitely speeds up the assembly of conduit runs for a housing project.

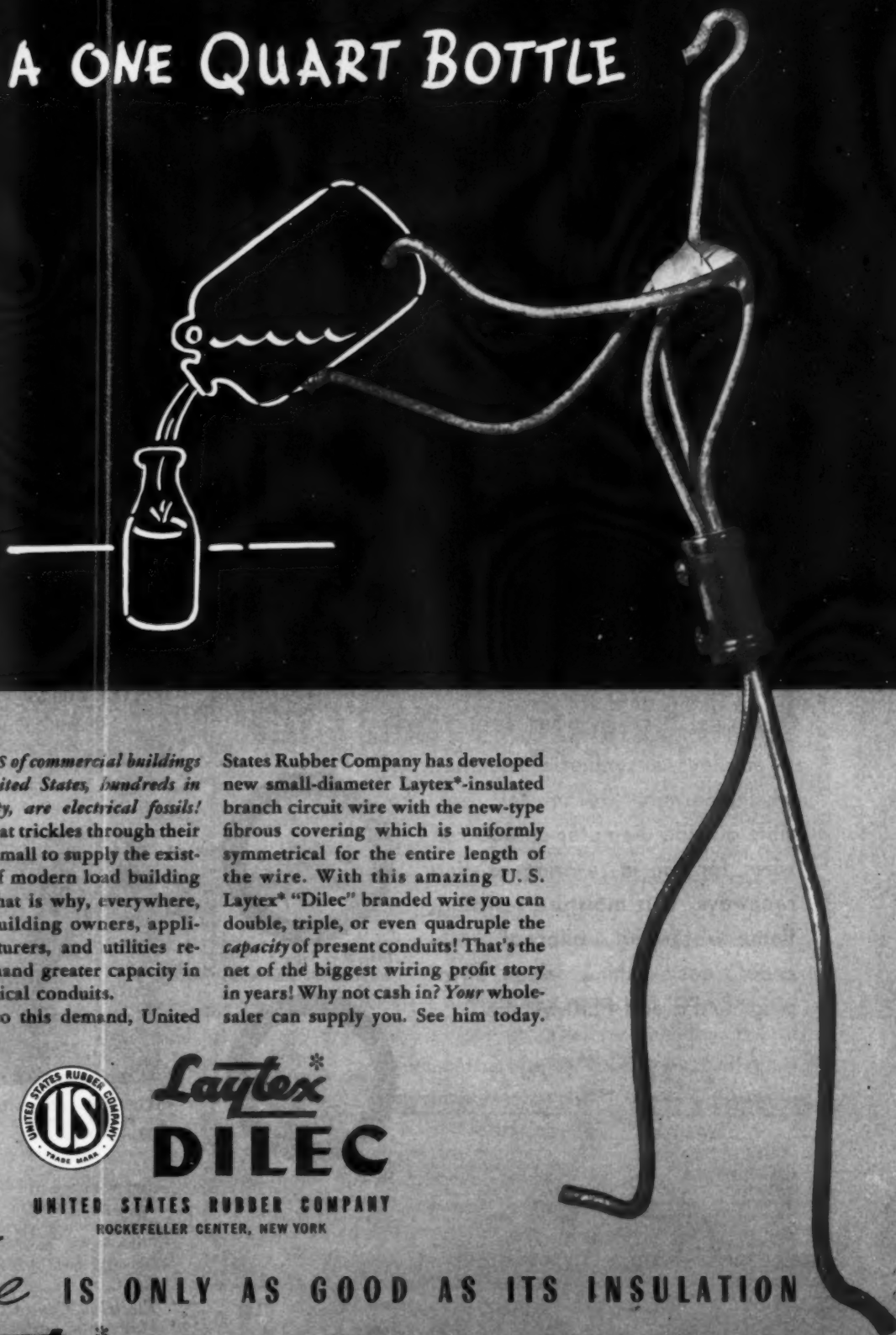
A clear strip of floor, the entire width of the shop, is used as a large measuring stick. The space is 12 or 15 feet long, depending upon the width of the field shop. Numerals are nailed to the floor to designate each foot or fraction thereof. It's the same as having a 12-foot rule on the floor. A sample length of conduit with a 90 degree bend at one end and with the proper riser height is permanently fastened to the floor and upright to act as a pattern.

The conduits to be measured are laid down alongside of the pattern and cut to proper length. Where possible, short scrap pieces of conduit bent into elbows are used with nipples to reduce conduit waste.

A schedule for each building unit is made and used in conjunction with the

Electrical Contracting, June 1940

HOW TO PUT A GALLON OF "JUICE" INTO A ONE QUART BOTTLE



THOUSANDS of commercial buildings in the United States, hundreds in your community, are electrical fossils! The current that trickles through their wiring is too small to supply the existing demand of modern load building appliances. That is why, everywhere, consumers, building owners, appliance manufacturers, and utilities require and demand greater capacity in existing electrical conduits.

In answer to this demand, United

States Rubber Company has developed new small-diameter Laytex*-insulated branch circuit wire with the new-type fibrous covering which is uniformly symmetrical for the entire length of the wire. With this amazing U. S. Laytex* "Dilec" branded wire you can double, triple, or even quadruple the capacity of present conduits! That's the net of the biggest wiring profit story in years! Why not cash in? Your wholesaler can supply you. See him today.



Laytex*
DILEC

UNITED STATES RUBBER COMPANY
ROCKEFELLER CENTER, NEW YORK

Wire IS ONLY AS GOOD AS ITS INSULATION

Laytex* IS INSULATION AT ITS BEST



YOU can change this picture with

CRESCENT SYNTHOL TYPE SN

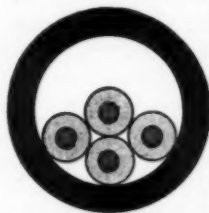
Small Diameter Building Wire

It employs a synthetic insulation which permits the smallest possible outside diameter on 600 volt wires for use in rewiring existing raceways. It is moisture resisting, flame retarding, oilproof, sun-proof, easy fishing, clean stripping, SAFE and PERMANENT

CRESCENT
INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati
Cleveland Detroit Indianapolis Kansas City
Los Angeles Minneapolis New Orleans New York
Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT ENDURITE SUPER - AGING INSULATION



Four #14 Type R Code
Wires permit 3450 Watts



Six #12 Type SN Small
Diameter Synthol Wires
permit 6345 Watts



[FROM PAGE 26]

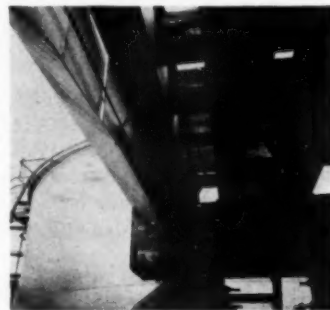
measuring system. The schedule lists the identification number of the branch circuit run, the length and a number of squares on the schedule indicate how many runs of this particular length are necessary for the unit. As each run of a particular length is made up an "x" is placed in a square opposite the circuit indication on the schedule, as illustrated.

Unit M									
Circuit Number	Length	Runs Assembled							
1	6'-4"	x	x	x	x	x	x	x	x
2	10'-5"	x	x	x	x				
3	9'-2"	x	x	x					
4	13'-8"	x	x						
5	12'-9"	x							
7	7'-6"								
8	10'-2"								

This system eliminates the necessity of the mechanic to consult the plans and fool around with a rule each time a circuit run is made up. It means a little more office work, but this is more than repaid by time saved on the job.

PROTECTED TROLLEY WIRES

A heavy shield of 10 gauge steel, installed by the Pacific Electric Motor Co., of Oakland, protects employees of the West Vaco Chlorine Products Co., Newark, California, from coming in



STEEL GUARD protects trolley wires of a low crane-way at West Vaco Chlorine Products Co., Newark, California.

contact with the trolley wires of a low crane-way. The crane, serving a large vat, is relatively close to the ground and the wires presented a hazard to those working in the vicinity.

Electrical Contracting, June 1940

FOR MAXIMUM LAMP PERFORMANCE

Fluorescent lighting in the Steel Sales Corporation offices, Chicago—Installation by Blue Ribbon Modern Light Co., Chicago.

Jefferson ballasts and Auxiliaries are made for single and two-lamp installations—and in high power factor types.

**For Greater
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USE JEFFERSON CONTROL EQUIPMENT

Fluorescent Lamp Ballasts and Auxiliaries

To make the most of daylight lighting with fluorescent lamps—to be sure of results that will bring you additional business and profits—consider carefully the selection of the Control Equipment.

Specialists for over 25 years—1915-1940—in the making of chokes, transformers and similar control units for Neon luminous tubing, X-ray lamps, mercury lamps—Jefferson Ballasts and Auxiliaries for fluorescent lamps incorporate the same degree of skilled engineering, liberal design, manufacturing craftsmanship and dependability for long hours of trouble-free service.... Advice on fluorescent lamp problems is available at all times. Write for Bulletin 401FL.

JEFFERSON ELECTRIC COMPANY

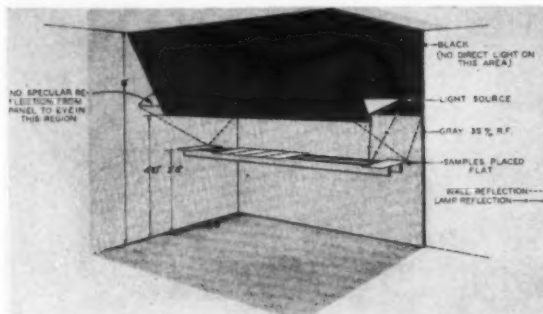
BELLWOOD, ILLINOIS

Canadian Factory: 60-64 Osler Ave., W. Toronto, Ont.

Better Lighting

A COLOR MATCHING BOOTH

The Forbes Varnish Company, Cleveland, have just completed an installation of fluorescent lamps for the check color matching of lacquers and baked enamel samples against standards.



ACCURATE COLOR
matching is possible with use of fluorescent lamps in this booth where comfortable seeing conditions exist. Construction details are shown.

The sketch shows the installation which consists of twenty-four 36-inch and twelve 18-inch, 1-inch diameter daylight fluorescent lamps. The booth is 90-inches long and 12½-inches wide and the lamps are placed in 12 parallel rows. The lamps are so located that there is little possibility of reflection of the source to the eye by the samples. The top and part of the back of the booth are painted a flat black and the unit is designed so that a minimum of light reaches this area, which is the section from which the light would be reflected to the eye of the inspector.

The fluorescent lamps are arranged on three circuits, each of which provides approximately 175 foot-candles. When matching whites and other colors of high reflection factor, only one circuit is employed, two circuits for colors of medium reflection factor and three, which produce in excess of 500 foot-candles, for matching blacks and other low reflection factor colors. The bank of lamps provides illumination which varies less than 10 per cent over an area 1 foot wide and 5 feet long.

Comfortable contrast is achieved by painting the lower part of the wall a gray having about a 35 per cent reflection factor.

Being illuminated directly by the fluorescent light source this area is relatively light. The inspector stands so that he sees this part of the wall as a background to the samples. Under these conditions, the brightness ratio between the samples and the background is approximately seven to one

which makes for very comfortable seeing conditions.

The installation was designed by A. K. Gaetjens of the Nela Park Engineering Department of the General Electric Company, Cleveland, and R. F. Wysocki of the Forbes Varnish Co.

FLUORESCENT UNITS

Sources of large luminous area and relatively uniform brightness may be obtained by employing the fluorescent lamps in suitably designed specular trough reflectors. Units of this type produce high illumination of good quality.



ity. Because the radiant heat from fluorescent lamps is only one-quarter that of incandescent lamps for equal foot-candles, a source of this type can furnish several hundred foot-candles without the discomfort from heat formerly associated with high intensities.



CAFETERIA LIGHTING—Ten foot-candles of indirect lighting enable the patrons of Chicago's Forum Cafeteria to make rapid selection of the tempting dishes offered on the menu. Special lighting units made by Solar Light Co. are used. These employ coffer 8-feet in diameter with semi-indirect troughs in which are placed 40 watt lamps on 6-inch centers. In addition to the general coffer system, indirect pendant units are used over the aisles and under the balcony.



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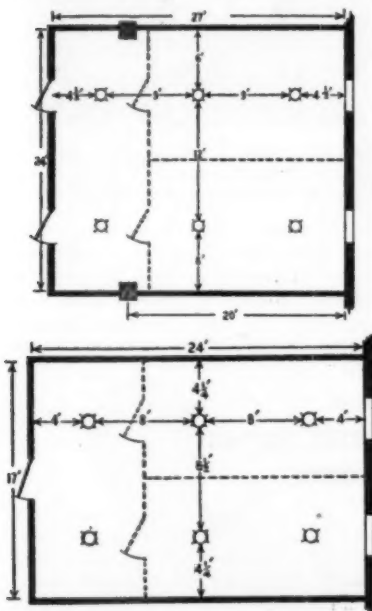
[FROM PAGE 30]



EIGHTY FOOTCANDLES—The Heating and Conditioning Division of the Norge Corporation, Detroit, is lighted to a level of 80 footcandles. The installation consists of 406 watt Type H mercury lamps and 750 watt filament lamps alternately spaced on 7½ by 10-foot centers. Ivanhoe porcelain enameled units are used and these are mounted 9-feet high. Trolley duct is used for flexibility. Intensity can be raised to a maximum of 250 footcandles.

OFFICE LIGHTING LAYOUTS

Where offices are built particularly for renting purposes, careful consideration should be given to locating the lighting units. They should be laid out in such a way that if old partitions must



be removed or new ones erected to suit the requirements of the new tenant, the outlets already installed will still be usable. The accompanying sketches of some typical office spaces show how this may be accomplished.

Electrical Contracting, June 1940

HOT PROFITS

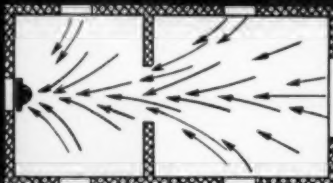
This summer selling....

ILG

NIGHT COOLING

DRIVE OUT

HOT
DAYTIME
AIR

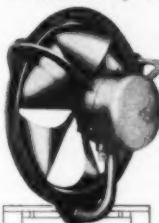


SUCK IN

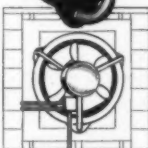
COOL
NIGHTTIME
AIR

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It's spreading like wildfire—the only practicable, economical way to C-O-O-L homes, apartments, stores and offices—ILG Night Cooling Fans. Full profit margin. No trade-in allowances. Wide-open market. Backed by promotional selling helps. Act fast—ask your distributor or write today for full details!

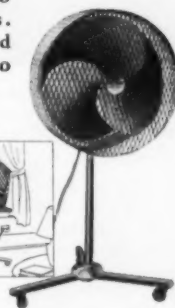
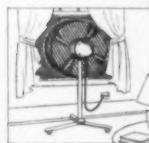


BUILT-IN TYPE For permanent installation in stores and offices, also attics of homes. Night operation drives out hot, daytime air; sucks in cool, refreshing nighttime air. Also operated during day for circulating air and ventilating building, if desired.



PORTABLE ILGWIND

Just place it in front of an open window and plug it in—no installation required! Ideal for night cooling of small stores, office suites, homes and apartments up to 8 rooms. Two-speed motor. Two sizes.



PORTABLE ILG ROLLAIRE

On casters, chrome-plated for streamlined modern appearance in apartments, small homes, offices, etc. Functions same as ILGWIND, driving hot air out, pulling cool night air in. Two-speed motor.



1938 WORLD'S FAIR "TOWN OF TOMORROW"
See ILG ATTIC System and ILG Kitchen Ventilating Fans in actual operation.



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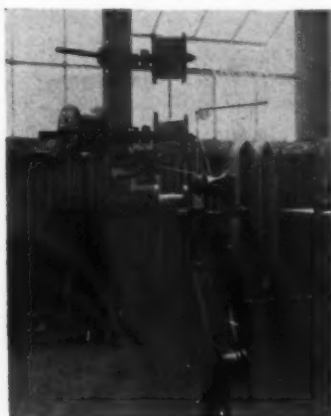
Motor Shops

WIRE SPOOL

BRAKE

A brake mechanism for maintaining tension on magnet wire used in rewinding operations has been devised by the R. A. Reed Electric Company of Los Angeles, California.

Steel plates mounted on the building column support split axles, each of which has a small adjustable spring brake, and



BRAKE MECHANISM and tension device control speed of unwinding and eliminate kinks in magnet wire on re-winding operation.

a cone shaped projection on the brake end of the axle. A bolt and cone shaped washer on the outer end are used to tighten the wire spool. Wing nuts on the brake permit close tension adjustments. Additional tension devices iron out the kinks in the wire before it reaches the winding machine.

LATHE LIMIT SWITCH

To eliminate waiting time and non-productive labor on lathe cutting operations, Walter J. Rider, Binghamton, N. Y., motor shop man, devised a limit switch. This device is made of a fibre block with an adjustable clamp and a normally closed contact inside of the block. A protruding fibre pin opens the



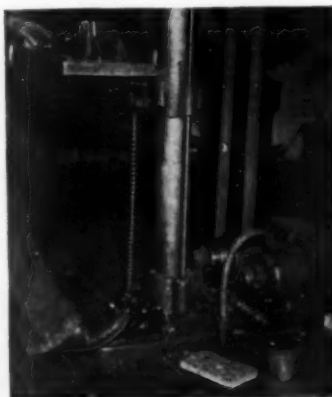
LIMIT SWITCH clamps on lathe at any desired point. Arrow shows fibre pin which lathe carriage contacts to open motor circuit.

contact when pressed. The switch is connected in series with the lathe starting switch.

For operations which require cutting only a definite distance, the switch can be clamped into position, the cut started, and the machine left to operate automatically. When the end of the cut is reached the tool carriage will strike the pin and open the motor circuit. Thus the operator can do other work while the lathe is in operation.

FOOT SWITCHES

Convenient switching of individual drive shop machinery can eliminate



FOOT SWITCH on drill press permits operator to keep hands and eyes on the work.

wasteful idling and unnecessary power consumption if the switch does not require extra attention from the operator. In the Chicago Electric Company shop, drill presses are operated by sturdy foot switches, leaving the mechanic's hands free to handle the work.

The switches are solidly mounted on the base of the drill press pedestal and can be locked in the open position to prevent accidental operation.

BAKE OVEN

Score once more for electricity. With no other fuel could Clarence D. Purkhiser, electrical contractor of Caldwell, Idaho, operate a bake oven for small motors under a wooden work bench. Using the large lower oven from an old Westinghouse electric range, he has installed it as shown in the photograph. The insulation of the oven is such that the surrounding wood only gets warm. On top is mounted a thermostatic con-



BAKE OVEN of an old electric range fits conveniently under work bench and operates efficiently for small motor work.

trol for maintaining the oven temperature during the baking out of coils and stators of motors up to 5 hp. and for coils for control equipment. This is a shop kink that saves space and because it operates efficiently, saves money as well.

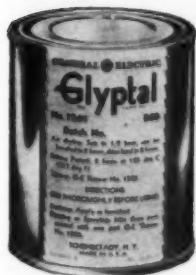
WEDGE FORMING MACHINE

Totally enclosed formed wedges are used by Electric Engineering and Service, Inc., of Westfield, Mass., to completely enclose the cell type slot insulation that they use in their motor rewind jobs. This type of formed wedge eliminates seepage of oil and dirt into the crack ordinarily left by the flat type wedge.

Max Hamann, works manager, designed a machine to form these new wedges. At present it is hand operated

Portrait of a Man who Demands QUALITY

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INSULATING
MATERIALS."



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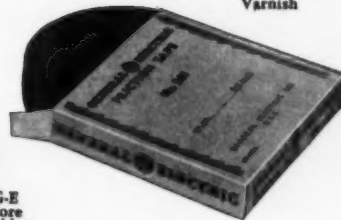
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Paste



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Tape



G-E
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Solder

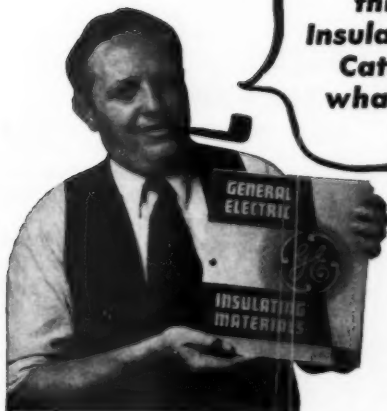


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BURNDY ENGINEERING CO., INC. • 459 E. 133rd ST., NEW YORK

Motor Shops

[FROM PAGE 34]

but provisions have been made to have it motor driven. The actual bending mechanism consists of a disk type roller keyed to the top operating shaft. This fits into a grooved roller which rotates freely on the lower removable shaft. The flat grey fibre is fed in to the machine and passes between the disk and groove coming out perfectly formed



WEDGE FORMING machine produces totally enclosing type wedges from flat grey fibre. Uniform width and well rounded crackless edges are features of the wedge.

as shown in the picture. Variable tension is provided by a spring on the bolt supporting the grooved disk mechanism. A complete set of disk and groove type rollers are provided to form wedges from $\frac{1}{8}$ -inch to $\frac{1}{4}$ -inch in width. The wedges are usually made up in three-foot lengths and then cut to desired lengths to fit specific motors.

PROTECTING PORTABLE METERS

Heavy corrugated paper shipping containers are convenient and serviceable protection for portable instruments that have to stand the rough handling of daily use in the shop.

Select a box into which the meter will fit loosely, trim it down to the face of the instrument, tape the cut edges and wedge the instrument in with extra sheets of corrugated paper. The box adds little to the weight of the instrument and saves it from most of the minor hazards of shop handling.



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Wires and cables beneath the streets, within the walls, a maze of cables everywhere.

Through them surges the vital force whereby the city lives—giant power, all-pervading illumination, the flash of

traffic lights, the rush of winging messages, or sudden fire alarm. For each service a

product engineered to a particular job and manufactured with the responsibility of General Cable behind it.



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Estimating

LIGHTING BEAUTY PARLOR BOOTHS

A fluorescent lighting installation was recently made in 18 booths of the beauty salon of the W. I. Addis Co. store in Syracuse, N. Y.

The partitions between booths were two inches thick and all wiring was concealed therein. Since the city electrical regulations prohibited the use of armored cable the installation was made with Code type building wire in flexible metallic conduit. One additional flush type lighting distribution panel was installed next to the existing one in the stairwell.

Each booth was equipped with three fluorescent fixtures, one on each side partition and one on the back wall over the mirror. The side fixtures were of the 24-inch lamp type with the tubes covered by curved frosted diffusing glass. The fixture over the back mirror is of the exposed type but is hidden in a cove.

The following is a list of the material used:

36—Garcy No. 6606 fluorescent units with two 24-inch lamps enclosed by a curved frosted glass.

18—Fluorescent strip units for one 24-inch lamp without the enclosing globes.

1400 feet— $\frac{1}{2}$ -inch flexible metallic conduit.

450 feet— $\frac{3}{4}$ -inch flexible metallic conduit.

6000 feet—No. 12 rubber covered Code wire.

1—14 circuit flush mounted lighting distribution panel.

The following is the labor breakdown on the installation of this equipment.

INSTALLING PANEL—includes cutting the opening in the wall adjacent to existing panel, setting the panel, making all feeder and circuit connections 16 m. h.

BRANCH CIRCUIT WORK—includes the necessary fishing of the circuits through the existing ceiling, the drilling of all partition studding, the installation of all outlet boxes and the installation of 1850 feet of flexible



CONSULTATION—George J. Martin, Jr. (left) and his dad discuss the plans and the specifications of a job they are estimating. This father and son combination guide the affairs of George J. Martin & Son, one of the larger electrical contracting firms in Albany, N. Y.

metallic conduit and 6000 feet of No. 12 rc. Code wire.

Total time 80 m. h.

Average time per foot of conduit043 m. h.

FIXTURE WORK—includes mounting and connecting 54 fluorescent units.

Total time 16 m. h.

Average time per unit296 m. h.

Labor used for supervision is not included in the above figures.

Data from L. W. Kiesewetter, Syracuse, N. Y.

Any Questions?

This department presents experience data on estimating—items you can cut out and put into your cost file for later guidance. We will be glad to publish similar data from you—and to pay for it.

Meanwhile, what about questions? If you are looking for experience on some particular operation, say so. We will try to get you the answer from other contractors.

SLIP RING MOTOR INSTALLATION

An eastern contractor doing work in a rock crushing plant in New Jersey was called on to connect two large slip ring induction motors to drive stone crushing mills. The motors were 440-volt three phase, one being 125 hp. and the other 100 hp. in size.

The building was constructed of steel frame and corrugated sheet steel sides. This necessitated making framework of angle and channel iron to rigidly support the resistance grids and control equipment, mounted side by side, for both motors.

The following is the labor breakdown of the installation, kept by the contractor for future reference.

FABRICATING FRAMEWORK FOR MOUNTING CONTROL EQUIPMENT—includes taking all necessary measurements, cutting, drilling, assembling and mounting the angle and channel iron framework for control equipment of both motors.
Total time 26 m. h.

MOUNTING CONTROLS—includes the actual mounting of two primary switches and two drum controllers to the predrilled supporting framework.
Total time 3 m. h.

INSTALLING CONDUIT—includes measuring, cutting, threading, fabricating hangers and mounting the conduit from the panel to the primary switches and the primary and secondary runs to each motor. Total conduit run was 30-feet $2\frac{1}{2}$ -inch, 70-feet 2-inch, 1- $2\frac{1}{2}$ -inch, 6-2-inch elbows. Conduit to switches was mounted on steel about six feet above floor, that to motors was suspended from steel about 12 feet above the floor.
Total time 24.5 m. h.

PULLING IN WIRE—includes measuring, un-reeling, cutting and pulling the primary and secondary circuit wires from panel to controls and to the motors. Wire installed included 205 feet No. 3/0, 145 feet No. 4/0, 60 feet No. 2/0 all rubber covered braided wire. All runs were short.
Total time 28 m. h.

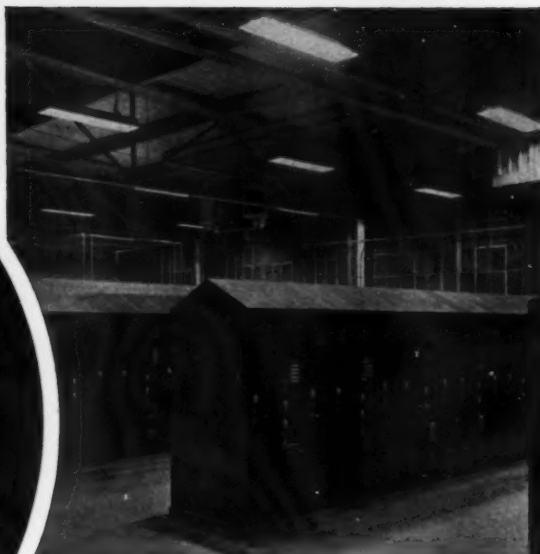
MAKING CONTROL CONNECTIONS—includes mounting two sets of grids, one of two and the other of three banks and making all connections from the grids to the drum controllers and from primary switches to drum controllers. Wire included 80 feet No. 1, 80 feet No. 6 asbestos covered slow burning wire.
Total time 18 m. h.

PANEL CONNECTIONS—includes skinning, and shaping the wire, mounting solderless lugs and connecting circuits of both motors to the panel switches.
Total time 1.5 m. h.

MOTOR CONNECTIONS—includes making the primary and secondary circuit connections to the motor leads on both motors.
Total time 4 m. h.

Total time on entire job 105 m. h.

Supervisory labor on job 12 m. h.



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Alzak Reflectors help you profit fully in using fluorescent lamps. You can get lighting approaching the quality and quantity of daylight illumination, at reasonable cost.

High reflectivity of Alzak Aluminum Reflectors gives maximum efficiency to your lighting system. Long life and ease of maintenance make annual

costs low. The surface is smooth, so dirt does not adhere to it. It will not chip, doesn't scratch easily, and can be readily cleaned with soap and water.

Aluminum is light in weight, so these reflectors place less burden on supports. They can be thick, making them rigid and sturdy.

Just as fluorescent lighting must be used correctly, for maximum efficiency and life, so too must care be used in selecting the right Alzak finish for each job. Any of the companies listed below will advise you. Or, write to us.

ALZAK REFLECTORS ARE MADE BY:

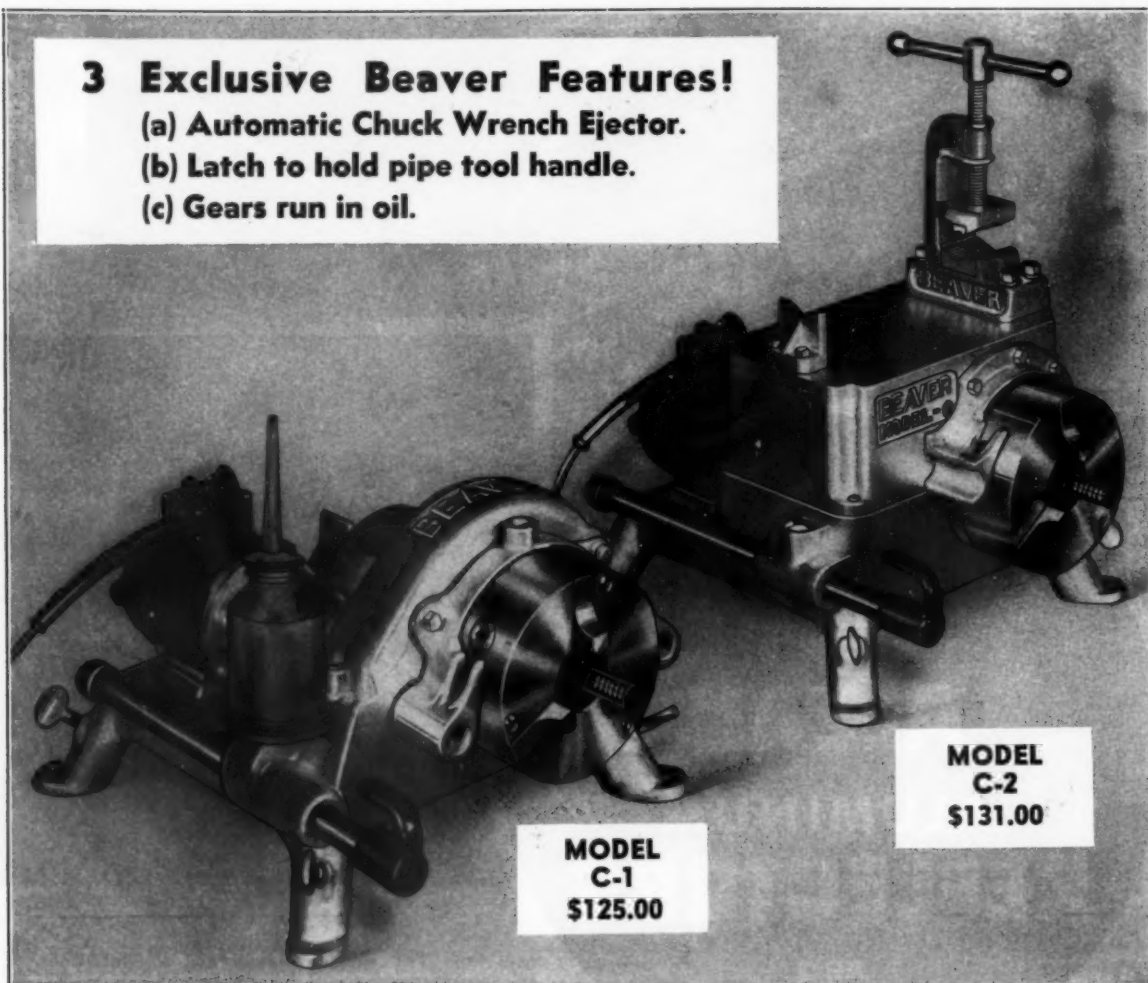
• Crouse-Hinds Co., Syracuse, N. Y. • Curtis Lighting, Inc., Chicago, Ill. • General Electric Co., Schenectady, N. Y. • Edwin F. Guth Co., St. Louis, Mo. • Kliegl Bros. Universal Elec. Stage Lighting Co., Inc., New York, N. Y. • Major Equipment Co., Chicago, Ill. • Miller Co., Meriden, Conn. • S & M Lamp Co., Los Angeles, Calif. • Thomas A. Edison, Inc., West Orange, N. J. • Westinghouse Elec. & Mfg. Co., Cleveland, Ohio.

We do not manufacture reflectors. The companies listed above, licensed under Aluminum Company of America patents, are well able to take care of your requirements.

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- (b) Latch to hold pipe tool handle.
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Make Power Tools of Your Hand Tools With BEAVER Model-C!

Convert your hand tools into electric tools to cut, thread and ream $\frac{1}{8}$ to 2-inch— $2\frac{1}{2}$ to 8-inch with drive shaft and geared tools. Bolts up to $1\frac{1}{2}$ -inch. Ample power for dull dies and low voltage. Choice of 110 or 220 volt Universal reversible motor. Equipped with automatic chuck wrench ejector and safety latch—to protect machine and workmen. With legs, vise and bender, Model-C is a complete Portable Electric Pipe Shop. Model C-1 is furnished without vise; Model C-2 accommodates vise.

Here are typical expressions from Electrical Contractors throughout the country.

From the Eskay Electric Co. of Staunton, Virginia, "Model-C is the answer to our problem of speeding up our jobs without tiring our men. All of the men want it."

From William Gens and Son of Boston "We also use our Model-C to operate our cable winch—and pulling wires through ducts. It more than paid for itself on the U. S. Marine Hospital Job."

From Evans Electric Construction Company, Kansas City, Missouri, "We like Model-C immensely—have two of them here on one job. They very quickly pay for themselves."

Write for complete illustrated Bulletin C



Highest Quality ★ WARREN, OHIO ★ *For 40 Years*

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AGAIN WE SAY "THANK YOU"

WITH this issue we reach the end of a series of 29 articles which have covered specific maintenance problems in the industrial and commercial fields. Periodically we have extended our thanks to a number of engineers and companies who have given us their help in this series of Maintenance Guide Sheets. And this time, we wish to thank those who have contributed to this series during the past six months.

E. R. Rath of Power Transmission Council, Inc.
F. L. Ives of Allis-Chalmers Manufacturing Co.
C. F. Hotchkiss, Jr., of Stow Manufacturing Co.
C. E. Bailey of T. B. Wood's Sons Co.
J. F. Howard of Boston Gear Works, Inc.
G. E. Gunderson of Foote Gear Works, Inc.
E. N. Bidwell of Whitney Chain & Manufacturing Co.
J. C. Bebb of Otis Elevator Co.
C. E. Hempsey of The Maintenance Co.
C. S. Schroeder of Yale & Towne Manufacturing Co.
Fred W. Aitz, Jr. of Link-Belt Co.
Arnold H. Gutzeit of Ilg Electric Ventilating Co.
Margaret Ingels of Carrier Corp.
Carl Heyel of American Management Association.

A New Series Starts in July

Next month we offer a new series which will cover functional problems of types common to most industrial and commercial plants.

These articles will be specific in their presentation of problems and solutions, but broad in their appeal to everyone who has any responsibility for the functions of industrial or commercial electrical systems.

And here are some of the subjects that will be covered—simplifying electrical maintenance; preventive maintenance; change-overs without interruption; reducing power costs; maintaining power factor; meeting severe service conditions; safety protection for electrical operations; increasing flexibility of electrical service; providing adequate capacity for increased demand.

Because this new series will cover a much broader field than pure day-to-day routine industrial maintenance, this section will be re-named **INDUSTRIAL ELECTRIFICATION AND MAINTENANCE**. Look for the first article in July—you'll find it of real value.

Maintenance

MANAGEMENT OF MAINTENANCE

THE maintenance of industrial electrical systems requires extensive knowledge of products and methods. The previous 28 articles in this series have covered a variety of these subjects. But effective maintenance requires management, too.

It does not matter who is doing the management of maintenance—both the industrial chief electrician who is on the job every day and the electrical contractor who is retained on a monthly or annual basis to do maintenance work, face identical problems. Some of these management problems are covered in this article.

Fixing Maintenance Responsibility—

In most plants it is highly desirable for the maintenance department head to take on all the responsibility he can, for in doing this he not only makes his own job bigger but he also ought to be able to make the electrical part of the plant function much better than if the works manager or some other department head tries to handle this work as a mere detail of the larger job.

Under an ideal set-up, the electrical maintenance chief would be given full authority to organize his department, would be responsible for cooperation with other departments in the plant, would have unquestioned authority to select and order the type of materials needed either for maintenance or for change-over jobs and it should also be up to him to know about new electrical developments and determine whether or not they can be adapted for use in the plant he is supervising.

In the general run of industrial plants there are not likely to be many executives with a knowledge of practical electrical work and if the plant chief electrician or electrical contractor can definitely prove his superior knowledge of this phase of plant operation, he is well on the road to being given the authority he needs to keep the electrical system operating perfectly.

Within the limits of responsibility that the top executives of the company allow him, the electrical maintenance chief has to plan out not only his own work but the work of his subordinates. For efficient operation this calls for the setting up of a maintenance budget, based upon past experience. Against

SCHEDULED INSPECTION, with delegated responsibility for it, is a prevention against trouble with electrical equipment — one phase of managing maintenance.



MOTOR RECORD					Card No. 1
H.P.	10	Volts	220	Phase	3
R.P.M.	1200	Amp.	28.1	Cycles	60
Rotor	sq. cage	Volts		Amp.	No.
Mfr.	WEM	Type	CS	Form	open
Shop No.	58	Style	low amp. current	Class	II
Bearings	Type Sleeve	Pulley Bear. No.		Front Bear. No.	
Brushes	Cat. No.	Quantity		Size	Material
Coils	Quantity			Cat. No.	
Drive Data	chain				
Installed Date	11-15-38	Dept.	A-9	Machine	No. 3 Conveyor
Purch. Order	38-174	Date	11-1-38	Cost	\$142.82
Received 11-12-38					

CONTROL EQUIPMENT		
Type	class 10-200 line starter with sep. stop button	Mfr. WEM
Cat. No.		Connection Diag. No.
Auxiliaries	2 stop buttons	
Purch. Order	38-174	Date 11-1-38 Cost \$42.82 Received 11-12-38

MOTOR SPARE PARTS					INSPECTION			
Date	Quan.	Parts Purchased	Cost	Used Date	Date	Remarks	Date	Remarks
					2-7	Grease on windings		

REPAIRS					SERVICE				
Date	Hrs.	Reason	Parts	Cost	Date Inst.	Dept.	Machine	Date Out	Reason
					11-15-38	A-9	No. 3 Conveyor	2-10-39	Clean windings
					4-21-39	D-3	No. 5 Conveyor		

RECORD CARDS provide a "case history" for electrical equipment in the plant. Above form is suitable for a.c. or d.c. motors. Lower illustration shows reverse side of card.

this budget, the maintenance chief will normally charge the day to day repair jobs and routine inspection operations of his department. A maintenance budget however, is not likely to be large enough to take care of major jobs. These are distinctly extra items and before such jobs are started, the electrical chief should prepare a fair estimate of costs and submit definite recommendations to the management regarding equipment to be purchased.

Keeping Wheels Turning—The number one job of the electrical department is to keep every machine operating every working hour in the year. Nothing takes precedence over this under normal plant conditions and if this objective is to be attained the head of the electrical department should have full authority to take whatever steps he needs at any time.

This function calls first of all for establishing a definite reserve stock of electrical supplies, spare motors, and motor controls, and various auxiliary equipment. In some types of plants, it may require the setting-up of a special list of workmen who are not regularly on the payroll but who can be called for emergency service.

In some plants it has become stand-

ard practice to let a motor burn up rather than take a machine out of service, because the cost of a new motor or a rewinding job proves to be much less than the cost of tying up plant production for even a few minutes.

In planning maintenance operations to reduce production interruptions, it will also prove helpful to plan for maintenance stations or cribs at strategic points and to plan out emergency routine ahead of time so that workmen can be sent to the point of trouble with a

minimum of delay. In a large plant this problem may be sufficiently important to warrant the training of repair crews in the speedy installation of replacement motors, motor controls and the like.

One place where the maintenance department head can do a great deal to eliminate production stoppage is in the design of wiring systems with ample factors of safety. This applies to the installation of feeders and motors capable of standing heavy overloads. But by handling maintenance in this way, management in the long run will get greater benefits from every maintenance dollar, and the electrical chief will have fewer headaches.

Routine Maintenance Operations—

The essence of management in any field is the establishment of orderly routine procedures wherever possible. Once electrical equipment has been properly selected and installed, preventive maintenance implies two things:

1. Scheduled inspection and care-taking to prevent breakdowns or faulty operation.
2. Periodic tests to determine conditions that do not meet the eye on scheduled inspections.

The frequency to assign to routines can be determined by a study of conditions under varying, recorded frequencies. Best intervals will naturally vary widely. In a foundry, electricians may examine motors and controls once a week, while in a screw machine department electrical inspection once in two weeks may prove adequate.

Planning for the Future—"Management" implies the ability to look ahead. All of industry is on the lookout for ways and means of reducing production costs, improving safety records, cutting down on the fatigue of workmen, and so on. The busy men in the front offices of most of our industrial plants have neither the time to look into every new electrical development, nor the

MAINTENANCE WORK ORDER				
To	Parker	From	Jackson	Date 4/9/40
Dept.	Electrical	Dept.	Garage	
Approved by	(when labor cost exceeds \$)			
Charge Dept.	26	Account No.	126-4	Machine No. 34
For	Adjustment of pressure switch on compressor			
Received	4-9	Assigned to	Marster	Job No. 14-21
Started	4-8	Finished	4-8	Time 1 1/2 hr.
Details of work done listed on reverse side				

MAINTENANCE ORDER FORM for electrical or other work, usually made in duplicate by foreman of department requesting work. When job is completed, filled-in form is put in machine record file.

MAINTENANCE GUIDE SHEET **29 CHECK QUESTIONS ON THE MANAGEMENT OF MAINTENANCE**

Phases of Management	Application Points	CHECK QUESTIONS	Phases of Management	Application Points	CHECK QUESTIONS
MEN	Selection	1. What records or special study can you cite to back up estimates of required manpower?	MACHINES (including auxiliary equipment) concluded	Upkeep (cont'd)	15. What operations or processes require spare equipment or parts to prevent long interruptions?
		2. What "man specifications" can you draw up for the various types of work in your department?		Operating as it affects maintenance	16. For what types of special control and other operations in your plant should a maintenance man be used, rather than an operating man?
		3. In your type of industry and company, what is the best "raw material" source for maintenance workers?			17. What changes in plant conditions—heat, dust, dampness, etc.—might affect operation of equipment?
		4. What results can the maintenance department expect from the apprenticeship system?		Work Initiation	18. How is maintenance work initiated? Beyond what estimated cost should executive approval be obtained?
	Training	5. How do you encourage the men in the maintenance crew to get the "plant perspective," i.e., to think instinctively of their work in terms of the plant as a whole?	METHODS	Scheduling	19. What types of maintenance work under your jurisdiction are repetitive?
		6. What training opportunities are provided? How can you supplement these for the men under your supervision?			20. On what data do you base the frequency with which repetitive maintenance work is done?
	Compensation	7. Have you developed written "standard practices" for certain types of jobs?		Cost Information	21. How can you cut down the time consumed and distance walked on repetitive operations?
		8. How does compensation for maintenance men compare to that of men of similar skill in other departments?			22. What equipment or auxiliaries require periodic tests?
	Selection of Equipment and Materials	9. Are incentives in general use in your plant? How could incentives be applied to maintenance work? Are time studies possible on repetitive maintenance jobs?		Keeping Up-to-date	23. What order forms are used to schedule maintenance? Do they readily show work ahead at all times? Can "paper work" be simplified?
		10. Does the maintenance department have adequate control over the choice of equipment?			24. How easy is it to arrive at costs of maintenance work?
		11. How can the maintenance department co-operate with the methods man in equipment placement?			25. What magazines in your field do you read?
		12. What tests on materials do you set up to insure getting the best for your needs?			26. Do you file manufacturers' catalogs?
MACHINES (including auxiliary equipment)	Upkeep	13. What kind of "history" do you keep on equipment repairs as an aid in selection?			27. What kind of ideas can you get from equipment salesmen?
		14. What type of repair operations should be contracted out?			28. What meetings of local and national associations do you attend? Are you active in them?
					29. What company or outside lectures or courses are available?

JOB SUMMARY SHEET																					
Job No. 3-40		Account No. 143-2 For Dept. <i>Office</i>										Estimated Hours 75									
Date Entered 4-17-40		Started 4-25-40										Finished 5-3-40								Actual Hours 73	
Description of Work:																					
<i>Unpack and install fluorescent lamps</i>																					
Employee		Daily Hours Charged to Work																			
		April										May									
No.	Name	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9					Total
5	<i>Andersen</i>	5	5	7	6	4	4	3													34
21	<i>Falk</i>	5	6	7	6	4	4	3													35
23	<i>Hast</i>	2						2													4
Daily Total		12	11	14	12	8	8	8													73
Summary of Labor		Act. Hr.		Cost		Summary of Material		Cost		Summary of Material		Cost									
Electricians		34		52.80																	
Helpers		35		35.00		730 ft. 3 wire No. 10															
Others (List)																					
<i>Laborer</i>		4		2.60																	

MASTER LOAD SHEET															
Week Ending 4-26-40															
Job No.	Description of Work	Charge Account	Date						Load Hours						Total
			Start		Finish		Electricians		Helpers		Others				
			Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.			
10-12	<i>Install 20 hp. 3-wire motor in B-5</i>	310-1	4/23	4/23	4/23	4/23	15	17	15	17	7	7		41	
6-9	<i>Replace 20 hp. motor on C-5</i>	256-9	4/24	4/24	4/24	4/24	6	6	7	6				12	
3-40	<i>Unpack and install fluorescent lamps</i>	143-2	4/25	4/25	4/25	4/25	35	35	5						

INDIVIDUAL LOAD SHEET													
Employee No. 5 Name <i>Andersen</i> Week Ending 4-26-40													
Job No.	Description of Work	Charge Account	Daily Hours Scheduled						Remarks				
			April Days and Hours										
			22	23	24	25	26						
13-12	<i>Install 20 hp. 3-wire motor in B-5</i>	310-1	7	7	3			<i>Install 2 extra stop buttons</i>					
6-9	<i>Replace 20 hp. motor on C-5</i>	256-9			4	2							
3-40	<i>Unpack and install fluorescent lamps</i>	143-2				5	5						

FOR DAILY SCHEDULING OF WORK where maintenance is extensive. Job Summary Sheet shows description of work, estimated and actual time, and material required; Master Load Sheet, jobs ahead for the week; Individual Load Sheet, assignment for an employee each day.

necessary experience to understand many electrical problems. Here, then, is a place where the man in charge of electrical maintenance can make himself invaluable to his superiors. It should be an important part of his job to keep abreast of every worthwhile new development in the electrical field. The time he takes to do this will most certainly not be wasted, however, because two things will be accomplished:

1. The electrical chief will get such a thorough knowledge of current developments that he will be able to select products or methods that can be properly adapted to his plant.
2. If the top executives know that the head of their electrical department will surely call to their attention any worthwhile new electrical development, it relieves them from the boring necessity of keeping an eye out themselves

for new things in this department of their business.

Personnel—A few general remarks are in order here about selection of manpower for the maintenance job. The good maintenance chief knows what he needs—he should work out with the personnel department the best means of obtaining it. Apprentice courses in the plant itself, "cooperative" trade schools and colleges (where students spend part time in school, part at work), and other sources of raw material should be considered.

The problem of estimating personnel requirements for maintenance work is always difficult. One method is to make a time study of work done by members of the department at different rates of plant output. A joint study of this sort made by the maintenance chief and

the cost department should provide some useful yardsticks.

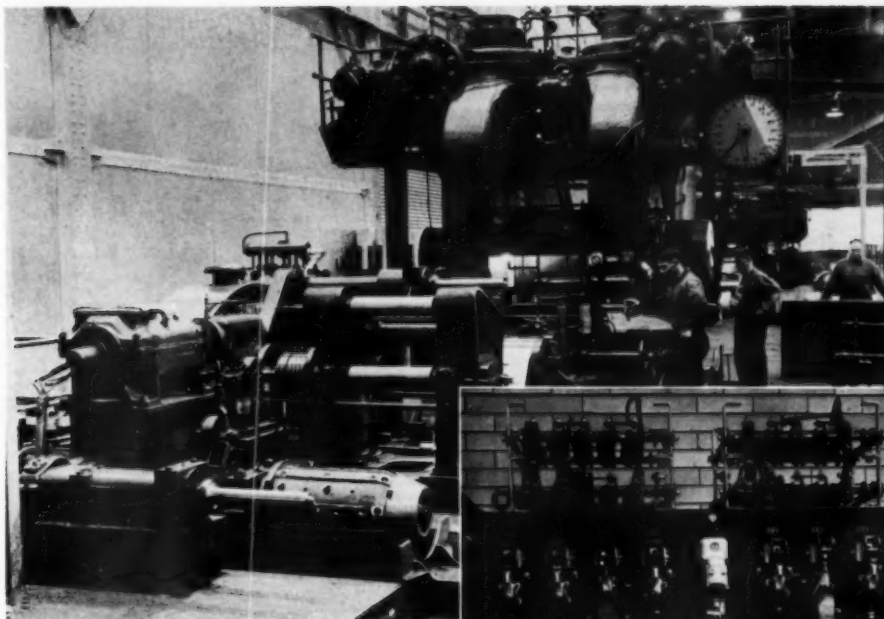
Paper Work—No one likes paper work. The keeping of records and the handling of inter-office correspondence is a nuisance that is always taking time from the other things. Nevertheless, it is an essential part of any department head's job and the only way to keep it down to a minimum is to plan departmental operations efficiently and try to operate with as few routine forms as possible. Paper work is necessary first of all, to make certain that routine maintenance work is being carried out on schedule. "Inspect inspection frequently" is a slogan that we are borrowing from the section engineer.

Forms are also necessary for the cost control of maintenance operations to furnish written authorization where the cost of a particular job is substantial. Where a budget has been established, cost studies by the accounting or cost department can be easily carried out if a code number is assigned to each general type of operation, this code number being noted on workmen's time cards and material requisitions.

Standard forms are desirable in order to provide a permanent record of a performance of various types or makes of equipment. An accompanying illustration shows a type of record which will prove useful in keeping a history of the performance of motor, transformers, magnetic clutches and other equipment. Another illustration shows a simple form that can be used where written authorization is required for work costing more than specified.

Where maintenance is extensive, it will pay to develop procedures for the daily scheduling of the work. An illustration shows a typical set of forms to accomplish this. The "Job Summary Sheet" gives a description of work given on a work order, with estimated hours required. This serves as an accumulator of hours spent on the job by various kinds of maintenance labor. The "Master Load Sheet" shows jobs ahead by classes of labor. The "Individual Load Sheet" assigns each job to a particular employee for each day.

Check Questions—No single discussion can, of course, hope to treat management of maintenance exhaustively. The main purpose of the points here reviewed is to stimulate thinking about the problem with respect to an individual situation. A series of check questions are listed in the accompanying chart. They break down the management problem into the classic divisions of "men, machines, and methods", and are carefully phrased so that a mere "yes" or "no" will not answer them.



To the right is an installation view of a "3C" Bulletin 9320 Screwdown and Bulletin 9310 Feeder Controls for one of the Reversing cold mills as shown above.

2-25 H. P., 3-35 H. P., and 6-15 H. P., 230 V., D. C. Motors are controlled by this type of apparatus on this installation.



8—"3C" Bulletin 107, 14" Brakes are also installed in this Mid-West Steel Plant rolling stainless strip, and "3C" Bulletin 7400 Heavy Duty Mill Type Contactors are supplied throughout the installation.

And this "3C" apparatus delivers service with utmost reliability, thus avoiding expensive shutdowns. Your Heavy Duty Electrical Control problems can be simplified by "3C" engineering and apparatus.



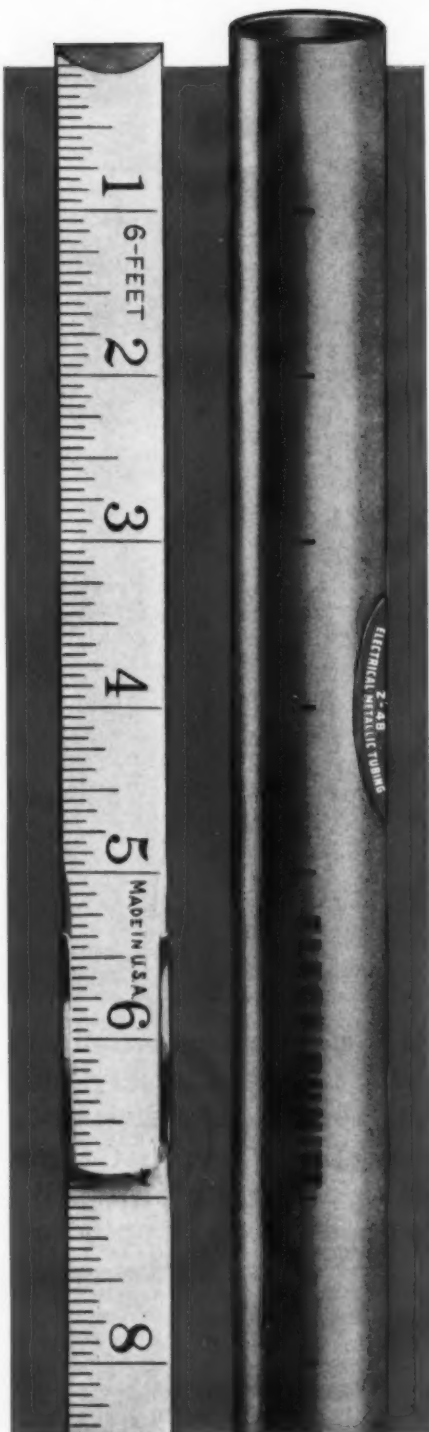
CONTINUE TO ROLL WITH CLARK CONTROL

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO



What a world of difference



"INCH-MARKED"

Patent Applied for

ELECTRUNITE

REG. U. S. PAT. OFF.

Steeltubes

has a continuous foot-rule on every length

● Just a row of little marks along one side of the tubing — but how much easier and more accurate they can make your work in installing electrical raceways!

They're simple — and practical — because they're inch marks, printed in blue ink and providing a continuous foot-rule on every length of "Inch-Marked" ELECTRUNIT STEELTUBES.

Thus, when you use "Inch-Marked" ELECTRUNIT STEELTUBES, the distance you need is already measured and marked. When you have a short length to cut or a bend to make, *it's easy to find your mark and keep it.* There's no slipping of rule or pencil — no juggling of a flat rule on a round surface.

Cut pieces and bends that always fit can be made easily and quickly. There is less chance for error — no need for guesswork — consequently, less waste of material.

Your ELECTRUNIT Distributor will soon have complete stocks of "Inch-Marked" ELECTRUNIT STEELTUBES. Ask him to let you see it. Ask him, too, to show you the new ELECTRUNIT Bender that permits the use of "Inch-Marked" ELECTRUNIT STEELTUBES to best advantage. Then use them on a job — and see what a world of difference a few marks make. Steel and Tubes Division, Republic Steel Corporation, Cleveland, Ohio.

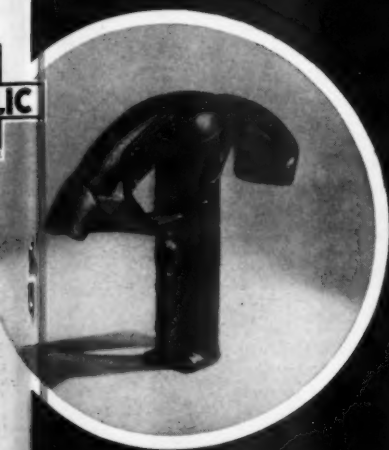


A NEW BENDER — A NEW LABEL — A NEW BENDING TAG



The new ELECTRUNIT Bender, shown at the right — with built-in instructions — makes any standard type or radius bend easily, quickly and accurately. The new bending tag, supplied with each bundle of tubing, provides detailed bending instructions and diagrams. And the new red and black label combines with "inch-marking" to identify genuine ELECTRUNIT STEELTUBES.

nce a few marks make!

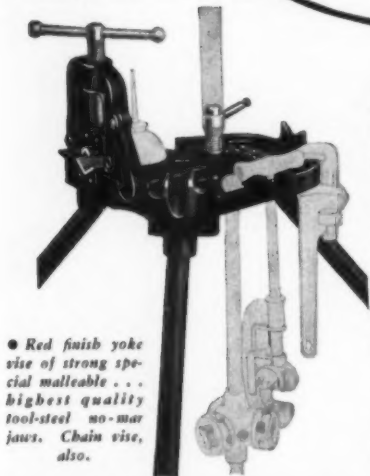


**SOLD EXCLUSIVELY THROUGH
ELECTRUNITE DISTRIBUTORS**

Get in touch with your local ELECTRUNITE Distributor. He carries complete stocks of high quality electrical supplies ready for prompt delivery—and he can be of help to you in figuring jobs and in completing them on time.



Gives you a
portable work bench—
New **RIGID**
Tri-Stand Vise



• Red finish yoke
size of strong special
malleable . . .
highest quality
tool-steel no-mar
jaws. Chain vise,
also.

A REMARKABLE WORK-SAVER, this new **RIGID** Tri-Stand really gives you a complete work bench, quickly set up where the work is. Its hinged legs fold in and chain for easy carrying. Nothing stingy about it—wide roomy tray for dope pot and oil can, special rim and slots for holding tools, a pipe rest and 3 benders that won't collapse pipe or conduit. Screw-down feet and ceiling brace, but it's well balanced to prevent tipping. For an unusually handy tool and more for your money . . . buy the new **RIGID** Tri-Stand at your Supply House. . . .

THE RIDGE TOOL CO., ELYRIA, OHIO

RIGID PIPE TOOLS



**DRILL HOLES
50-75% FASTER!**

Amazing new drill-point contains special metal harder than hardest steel. Goes through concrete, tile, slate, porcelain, etc., 50 to 75% faster. Drills cleaner, more accurate holes. Speeds up installation of expansion anchors. Saves your skilled time for more profitable work. Eliminates noisy hammering, monotonous chiseling. Doesn't splinter fragile work. No special equipment needed—use in any rotary drill. Get your share of those extra profits now possible. Send coupon for leaflet.

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11135 E. 8 Mile Ave., Detroit
Send free leaflet on Carboloy Masonry
Drill-Points, for drilling 75% faster.

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CARBOLOY
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CARBON BRUSHES

for
REFRIGERATOR • WASHER
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and Other Small Motors



**HELPING
YOU KEEP
FAITH**

WITH the
trade you
serve . . .

For brush replacements, **SUPERIOR CARBON BRUSHES** give you sure performance . . . for they are made specifically for the exact motors to be served . . . recognized for their superiority throughout the trade.

SUPERIOR
CARBON PRODUCTS, INC.

All That The Name Implies

9115 George Ave.

Cleveland, Ohio

for **FRACTIONAL
HORSE-POWER
MOTORS**

ALSO FOR OTHER CLASSES
OF MOTORS

Air Circuit Breakers Reduce Maintenance

Moline-Rock Island Mfg. Co., Moline, Ill., after eight years of experience with air circuit breakers, states that their maintenance expense has been appreciably reduced. The breakers are inspected regularly twice a year and also



EASE OF INSPECTION, reduced maintenance expense and increased safety are obtained by self-contained, truck-mounted, 15-kv. air circuit breakers in Moline station. (Westinghouse photo)

after interruptions by severe short-circuits.

On twelve of the 15,000-volt tie lines, it has used De-ion breakers. Maximum operations on any one breaker has been 34 per year. Total number of automatic openings on all breakers averaged 12 per year.

Photoelectric Control Saves \$15,000 Per Year

A photoelectric system of four-color register control on a rotogravure press of the Philadelphia Inquirer has cut waste expense from about 7 per cent to approximately 3 per cent, thereby saving an estimated \$15,000 per year. With this system, registration of four colors can be maintained automatically within the tolerance permissible for intaglio or rotogravure printing when operating at web speeds of approximately 1,000 ft. per min.

The control system, developed by the General Electric Co., incorporates two photoelectric scanning heads for each color unit. One head is aligned to scan the margin of the web, on which equally spaced register or index marks are printed simultaneously with the first color impression. The second head scans a disk on the printing cylinder.

Now You Can PLAY SAFE at LOW COST



We've Reduced the Price of G-E Midget Metal-Clad Switchgear

for Protection of Circuits
600 to 5,000 Volts*

*Such as incoming lines, power
feeders, and motor circuits

High-Quality Equipment for the Low-Price Field

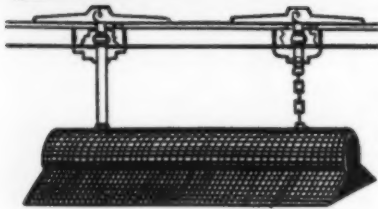
Completely metal-enclosed — NO HAZARD TO PERSONNEL
Removable breakers — EASY MAINTENANCE
Liberal Insulation — SERVICE CONTINUITY
Co-ordinated circuit components — BALANCED DESIGN
Sturdy mechanical interlocks — SAFETY FOR OPERATORS
Self-contained control — REDUCED STATION COST
Factory-built complete — A TESTED, FINISHED JOB
Shipped assembled — LOW AND PREDICTABLE
INSTALLATION COST
Choice of colors — ATTRACTIVE APPEARANCE



Write for GEA-2249C. Get complete information.
General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

★ For
Best Results



HANG
FLUORESCENT
LIGHT FIXTURES
WITH PAINE
ANCHORS

That Give Permanence
To All Installations
In Existing Buildings

PAINE OUTLET BOX
AND FIXTURE
HANGER

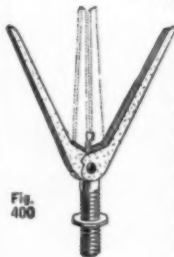


Fig.
400

The most efficient anchor for hanging large Fluorescent Fixtures with chain or tubing suspension from tile, metal, lath plaster ceilings. Key through center of nipple locks wings securely. Will hold up to 200 lbs. Approved by Underwriters' Laboratories, U. S. A. and Hydro-Electric Power Commission, Canada.

PAINE BUTTON-HEAD
MUSHROOM
TOGGLE BOLT

An ideal anchor for hanging the smaller Fluorescent Fixtures in hollow ceilings—Adaptable for tubing or chain-type installations. Spring spreads wings automatically, providing secure anchorage.



Ask your Supply House for Detailed Information TODAY or write us direct and ask for complete catalog featuring Lead Anchors, Expansion Anchors, Mallen Shields, Cable and Conduit Clamps, Romex Straps, Pipe Straps, Switch Boxes and "Sudden Depth" Drills.



THE PAINE COMPANY

2961 Carroll Ave. Chicago, Ill., U. S. A.
Eastern Warehouse & Sales: 48 Warren St., N. Y.

Register correction is accomplished by a reversible pilot motor so geared to the cylinder driving mechanism as to alter the angular displacement of the cylinder with respect to the preceding impression. A corrective motion is thus applied by the pilot motor in response to the corrective impulses from a "mixing panel" relayed through close-coupled thyatron power tubes.

With this method of automatic register control, each color cylinder is regulated independently to register with the initial impression as each successive color unit scans the same preprinted register marks on the web.

**Air Conditioning
Problem Solved**

Recent modernization changes had seriously restricted ventilation on the second floor of the Globe Department Store at Scranton, Pa. The management decided to air condition the area but a survey by the Scranton Electric Co. showed that a central plant installation would be impractical. Floor space was inadequate and expense would be prohibitive. Also, each department to be conditioned was isolated from the others, greatly complicating any duct system from a central plant.

The solution was the installation of seven unit air conditioners which can be placed at any location on the floor. With this arrangement, ductwork is not visible from the selling area, only the grilles being in sight.

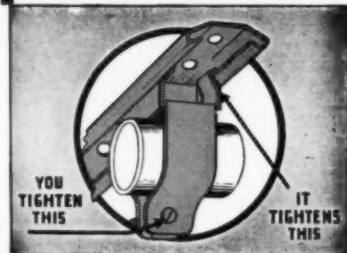
According to the Globe management, all the old objections to air conditioning installation were eliminated. Only small sections of easily spared stock-room space were required for the equipment. Normal business was not interrupted during installation. Practically no redecoration was necessary. The



AIR CONDITIONED—Seven unit air conditioners take care of this selling area on the second floor of a department store. Only grilles are visible.

With Only One Screw
to Tighten. . . .

**THE CLEVELAND
CONDUIT HANGER**



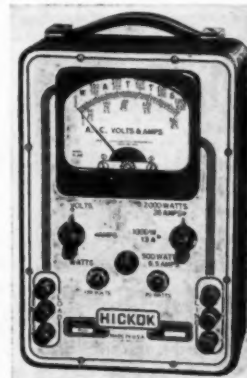
Gives You a Quicker
Easier Installation

"CONVINCE YOURSELF"

"Send for Circular
Giving Full Details"

THE CLEVELAND SWITCHBOARD CO.
2927 E. 79 St. Cleveland, Ohio

**1 DOES IT ALL
HICKOK
VOLT-AMPERE-WATTMETER**



**A.C. CIRCUIT
ANALYZER**

15 Meters in
One.

WATTS: 0-20-
100 - 500 -
1000 - 2000

Uniform watt-
meter scale.

CURRENT: 0-
26 - 1.3 - 6.5-
13-26 amps.

VOLTS: 0-130-
260.

Also tests electrical appliances from clocks to cooking ranges operating on the three wire Edison Circuit. All necessary leads and connectors available.

This is just one of the many types of Hickok built electro-dynamometer wattmeters.

Write for Bulletin 900.

ADDRESS ALL INQUIRIES TO
THE HICKOK ELECTRICAL INSTRUMENT CO.
10514 DUPONT AVE. CLEVELAND OHIO U.S.A.



UNIT AIR CONDITIONER installed in stock space behind selling area also provides cooling for dressing rooms. (General Electric photos).

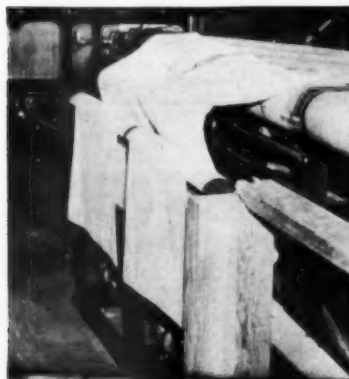
time required for installation was brief. Another important point—the unit conditioner system permits the department store manager to arrange sales sections to meet varying demands. Both unit and ductwork are easily moved.

Since seven units are in use, there are seven locations for thermostatic control. As a result, areas can be conditioned independently as cooling is required. Four of the conditioners utilize an adjustable outside air supply, and at night the fans alone are used to bring in cool night air, resulting in lower fan cooling cost. In the morning when the regular cooking is begun, the compressors rarely start for two hours because of the night-time operation, thus further reducing operating costs.

Pillow Cases

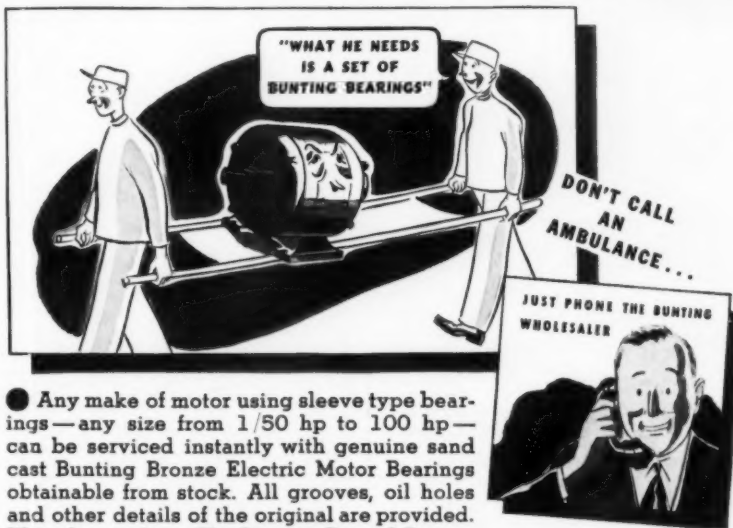
"Float Through the Air"

Photoelectric control and an air doffer comprise an automatic device for handling textile and laundry materials from conveyor to stack pile. Two of these devices are being used on an ironer in the Danvers Bleachery at Peabody, Mass.



PHOTOELECTRIC CONTROL helps in stacking pillow cases on horizontal bar, as they come off conveyor belt.

FIRST AID FOR ELECTRIC MOTORS



● Any make of motor using sleeve type bearings—any size from 1/50 hp to 100 hp—can be serviced instantly with genuine sand cast Bunting Bronze Electric Motor Bearings obtainable from stock. All grooves, oil holes and other details of the original are provided. Write for catalog...The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

BUNTING
BRONZE BUSHINGS • BEARINGS
PRECISION BRONZE BARS • RABBIT METALS

● Completely finished bearings for production and maintenance of industrial machinery are also available from stock. Write for catalog.

SAVE 25% on FITTING COSTS!

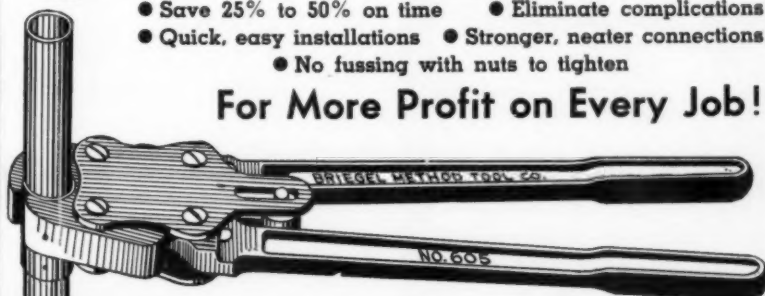


B-M connectors and couplings, plus the Patented B-M Indenter shown below, are all you need. Use this SIMPLE METHOD . . . cut down your fitting costs and handling.

ALSO:

- Save 25% to 50% on time
- Eliminate complications
- Quick, easy installations
- Stronger, neater connections
- No fussing with nuts to tighten

For More Profit on Every Job!



\$1.35 Buys the One Tool Needed

This one patented tool (1½" B.M. Indenter) handles 80% of all installations. Pays for itself many times over on the very first job.



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50%
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75% **FASTER DRILLING**
IN
CONCRETE—BRICK, etc.

**AND OTHER
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MATERIALS**



**CUT
DRILLING
COSTS**
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**SUPER CARBIDE
TIPPED DRILLS**

- Straight, true holes without damage to costly building materials.
- Many more holes per grind—and many more holes per tool.
- Rapid installation of expansion shields due to clean holes of correct size.
- Drill in occupied buildings without noise.

Write to

SUPER TOOL COMPANY
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For Better Service—

INSTALL **TRICO**

RENEWABLE FUSES
With the famous Powder-Packed Element

KLIPOK CLAMPS
Lock fuses and clips together

KANTARK FUSES
With genuine fibre tubes (not paper)

COLORTOP PLUG FUSES
The color tells the size

FUSE PULLERS
Pull and replace fuses safely

GLASS OILERS
For motors, line shafts, solid bearings etc

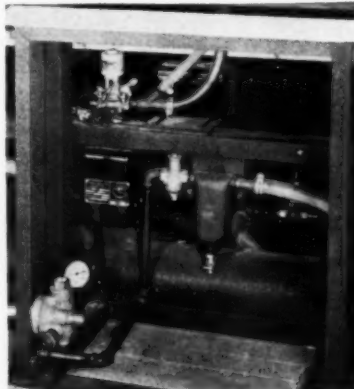
UNBREAKABLE OILERS
"Opto-Matic" Constant level type Gravity Feed type

WRITE FOR FOLDER CPF-300

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

Pillow cases pass through a large ironer onto a conveyor belt. The difference in speeds between the conveyor belt and the ironer space the pillow cases from six to eight inches apart.

The leading edge of the case on the conveyor interrupts a light beam and resets the mechanism for an operation. As soon as the pillow case passes beyond the light beam and allows the light to be projected to a phototube, a solenoid valve is opened for a period of approximately 0.3 second. This time is controlled by the vacuum-tube timer.



ELECTRIC EQUIPMENT for automatic air doffer; photoelectric relay on shelf; solenoid valve at left; and time delay relay below valve. (G. E. photos)

The opening of the solenoid valve allows air at approximately 15 lb. pressure to enter two horizontal perforated tubes. One tube blows air against the leading edge of the pillow case while the second tube blows air towards the lagging edge of the case, passing it to the horizontal bar which is the receiving rack.

Ordinarily a small percentage of the cost of a machine is represented in control equipment. In this case, however, practically 100 per cent of the machine is control, with the exception of the framework in which it is mounted, a regulating valve, air tank, and some piping.

Draftless Ventilation

During the warm months, ventilation can be obtained in plants and offices by natural draft, that is, by opening windows and doors. However, the most efficient way to obtain an adequate supply of fresh air indoors and to provide for air circulation is to use electric ventilating equipment.

Fans and blowers should be applied according to the particular need. A ventilating system that will adequately serve one office or department may not be suited for another. Each installation is a separate study.



**WOLVERINE
SOLDERING LUGS**

- **High-Conductivity**
- **Square-End**
- **Uniform Dimensions**

BUY FROM YOUR JOBBER



WOLVERINE TUBE CO.
DETROIT, MICHIGAN

XL-WAY REBUILT MOTORS



Excel Electric Service Co. offers to discriminating buyers at a substantial savings **XL-way Rebuilt Motors**—"Re-manufactured the XL-way without a change in original manufacturers specifications."

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CONDUIT FITTINGS **GEE-VEE** CABLE FITTINGS
GROUNDING DEVICES

**NEW
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CAST IRON BOXES**

Flanged, Un-flanged and Weatherproof types that simplify installation and give permanent, dependable service.

Write for full information
THE GILLETTE-VIBBER CO.
NEW LONDON, CONN.

- 
1. EASY TO SELL
 2. EASY TO INSTALL
 3. SAVES "CALL BACKS"

3 WAYS YOU PROFIT When You Use G-E CONTROL

YOU save time in closing the contract when you include G-E control in your bid, because customers recognize and prefer it. Your men find G-E control easy to install. And once you put in a G-E job you are assured of dependability that will please your customer and save you troublesome and costly "call backs."

Ask Us Another

"Is there any standard practice as to the size of conduit knockouts in control devices?"

In designing any control, the maximum current and the minimum current likely to be required for the motor is first determined. Combination knockouts are provided which will accommodate any size of conduit from the largest to the smallest that might be required, plus knockouts for control wiring.

"When is full-voltage starting of a-c motors recommended, and where must reduced-voltage be provided?"

In general, any induction motor can be started on full voltage. However, before deciding upon full-voltage starting, make sure (1) that the power supply is suitable and (2) that the driven machine can withstand full-voltage starting. If it is found that full-voltage starting is not suitable, a reduced-voltage starter should be provided.

"What types of reduced-voltage starters are available, and which is the more desirable?"

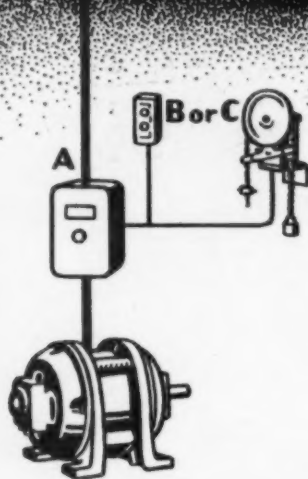
Reduced-voltage starters are of either the resistance or the autotransformer type. The autotransformer-type starter is preferable, because it affords the highest torque per ampere.

**HOW TO GET THE
BIGGER JOBS**

...are
typical
point of
economy

It's Easy to See Why

You Can Get the BIGGER JOBS with G-E CONTROL



ALMOST any large electrical contract involves the installation of a large variety of controls. When you use G-E control, you are in line for the bigger (and more profitable) jobs, because you have more different types and forms of control to choose from. A few of the representative types are shown at the right.

Your G-E distributor will be glad to discuss these controls with you, show you how easy they are to apply and install. Or if you wish, we shall be glad to send literature on any in which you are interested. General Electric Company, Schenectady, New York.

Note: In general, these pilot controls are for operation of a motor through the use of a magnetic starter. However, some of these devices can be used for direct control of a motor without a magnetic starter.

A DEVICES TO HANDLE MOTOR CURRENT

Manual Starters for Direct Control



Manual starter (CR1061), with overload protection, for fractional horsepower motors. (Cannot be operated by pilot devices at the right.)



Full-voltage manual starter (CR1062). Provides control and overload protection for motors up to 7½ hp. (Cannot be operated by pilot devices at the right.)



For motors where power restrictions demand limited starting current, use this autotransformer-type manual starter (CR1034). (Cannot be operated by pilot devices at the right.)

Magnetic Starters for Use with Pilot Controls at Right



This magnetic starter (CR7006) opens or closes motor circuit magnetically upon impulse from pilot devices; provides overload and undervoltage protection—for motors up to 500 hp.



Combination of a magnetic starter with a motor circuit switch and fuses makes this a complete, easy-to-install control in a single safety-interlocked cabinet (CR7008).



For motors on power lines where starting current is limited, use magnetic autotransformer-type reduced-voltage starter (CR-7051). Provides overload protection, and operation from remote stations.



B MANUAL PILOT CONTROLS



Push-button station (CR2940-BS79). Causes a magnetic starter to start or stop a motor. Momentary-contact start button closes starter and stop button opens it.



Three or more buttons can be provided for reversing starters, etc. Special enclosures are available for watertight, oil-proof, or hazardous locations.

C AUTOMATIC PILOT CONTROLS



Float switch (CR2931). Causes motor to start or stop according to level of liquid in an enclosed tank or reservoir.



Pressure switch (CR2927). Controls motor or compressor to maintain set pressure, or to sound alarm on excess pressure, etc.



Limit switch (CR9440). Reverses direction of travel, prevents accidental overtravel, interlocks electric circuits with mechanical motion.



Photoelectric relay (CR7505). Provides means for counting, limiting, protecting, turning on equipment as an object passes through a light beam.



Automatic timer (CR7504). Permits operation for a given number of seconds and then shuts motor down; causes another to start in sequence; etc.

General Electric, Section 676-10
Schenectady, N. Y.

Please send me your new publication GEA-3005, which gives prices and data on the above controls.

Name.....
Firm.....
Address.....
City..... State..... 676-10

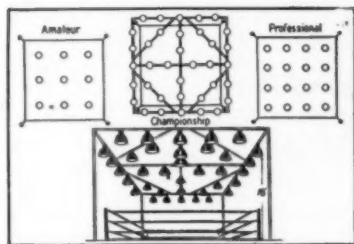
GENERAL  ELECTRIC

676-10

Summer Sports Lighting

[FROM PAGE 18]

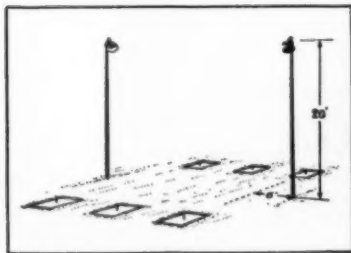
are crossed to eliminate distorting shadows. Type of projector: medium angle 40 deg. spread lens. Location—about 25 feet back of shooting line at a height of approximately 10 feet. Lamp size—1000-watt. Above each shooter's stand, except at station No. 8, place one 100-watt lamp in an RLM dome to facilitate loading and aiming.



BOXING—The level of illumination required for boxing is dictated by such considerations as the size of the audience, importance of bout, and whether or not motion pictures are to be taken.

Championship: Type of reflector: open concentrating. Location—26 units, 18 feet above the ring and spaced as shown in sketch. Lamp size—1000-watt. Footcandles recommended—500 or more.

Average bouts: Nine or sixteen 1000-watt units, according to the bout's importance, uniformly spaced above ring to produce 100 or 200 footcandles. Other specifications are identical with those for championship exhibitions.



HORSESHOE COURTS—For one to three courts: Type of reflector: elliptical angle. Location—on 20-foot poles as illustrated. Lamp size—300- or 500-watt.

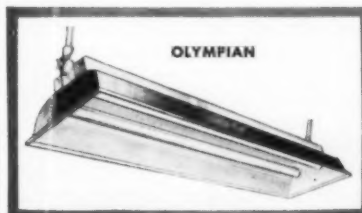
For more than three courts: Place, in addition, one RLM dome with a 300-watt lamp on a 20-foot pole halfway between the pitching lines and midway between the pits of two adjacent courts. Large groups of courts may also be satisfactorily lighted with large open-type reflectors and 1000-watt lamps in the same relative position as shown in sketch. Ten footcandles are recommended.



For a Variety of Industrial Uses

Wherever you want "daylight" quality for general or local industrial illumination, be sure that you also get the utmost in lighting efficiency with fixtures that are correctly designed. Several of the most popular Goodrich Fluorescent fixtures are shown below. All are

furnished complete with ballast equipment, replaceable starters and adjustable bracket for chain or conduit mounting. Freedom from reflected glare is assured by their high quality porcelain enamel finish—permanent, easy to clean.



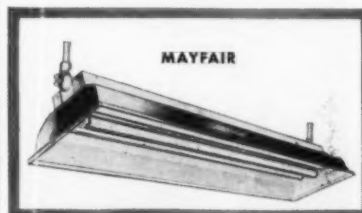
OLYMPIAN

• Deep-skirted reflector with closed ends, provides proper light control; shields lamps to prevent glare. Reflector and hood are separable. Uses two 48" lamps.



AVONDALE

• Open-end design with detachable reflector provides easy wiring and servicing. Reflector may be suspended from hood on open hinge while line connection is made. Uses two 48" lamps.



MAYFAIR

• Recommended where higher intensity and proper light control are essential. Reflector may be detached from hood or suspended from it on open hinge. Uses three 48" lamps.



HILLCREST

• Apertures in top of reflector direct portion of light toward ceiling to improve general illumination. Finished entirely in white porcelain enamel. Uses either two or three 48" lamps.

Write for catalog sheets. Ask us to put your name on our mailing list to receive news of coming developments in Goodrich Fluorescent Fixtures.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES
GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

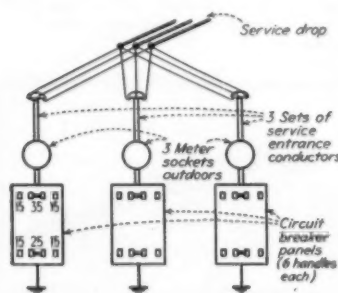
Questions ON THE Code

Multiple Service

Q. "Is this sketch a correct setup under the Code?"

"Branch circuit breaker panels are all similar to one shown and mounted indoors. There are 3 apartments in the building and breakers are readily accessible to all.

"Is this setup permissible under Section 2351-b, or is it necessary to install a main switch or breaker ahead of each breaker panel? The supply is 110-220 volts a.c."—D.S.P.



A. The setup is not correct as shown. A main switch or circuit breaker is required ahead of each panel. The service drop must, of course, be of sufficient carrying capacity.

The sketch indicates that there are three (3) circuit breaker panels and that each panel requires six (6) operations to disconnect all of the circuits connected to it, which would make a total of eighteen (18) operations necessary to disconnect all of the circuits in the house.

The Code permits but six total operations and therefore a main switch (or circuit breaker) would be required ahead of each panel, a total of three (3) switches which would thus require but three (3) operations to disconnect the entire current from the house.

Conduit in Theatres

Q. "Kindly give me the official ruling or interpretation of Section 5211 Article 520.

"My understanding was and is, that

the construction must consist throughout of rigid conduit. Feeders, branch circuits, etc., switch to panel—panel to opening and opening to opening.

"Has there been any abatement whereby flexible steel conduit may be used. If so, to what extent and where?"—H.R.S.

A. Section 5211 of Article 520, rules that the wiring methods permissible in theatres, including motion picture houses are, "Metal Conduit or other approved metal raceway systems."

"Metal conduit" includes rigid metal conduit (Section 346) and flexible metal conduit (Section 350). "Approved metal raceways" according to the definition of Raceway in Article 100 includes, rigid metal conduit, flexible metal conduit, electric metallic tubing, underfloor metal raceway, surface metal raceways, metal wireways, metal busways and metal auxiliary gutters.

Our inquirer has hit upon one important subject in his question. He



AGGRESSIVE PROMOTION of new lighting business is slated for special attention this year by the Scott Electric Co. organization of Memphis, Tenn., says contractor W. R. Scott. Low rates, new fluorescent lamps and improved business conditions point to a profitable market in the Mid-South.

asked for an "official ruling or interpretation." Our answers in this column to all of the questions are NOT official interpretations and must not be considered as official. They are merely the views and opinion of the Editor of this column.

The procedure for obtaining official interpretations of the Code is to be found in the "Appendix" on pages 318 and 319 of the Code. To obtain an official interpretation the inquirer must furnish the Chairman of the Electrical Committee with five identical signed copies of his question.

Demand Factor

Q. "Is there any Demand Factor which can be applied to a space heating load such as from 5 to 15 kw. distributed among several rooms of a house? There is no other means of heating and our coldest temperatures the past eight years has been 9° above zero. We have very cheap Boulder Dam power and have just realized its advantages for heating purposes. About 1/3 of the 600 homes here are using electric heat or preparing to do so."—D.S.P.

A. The demand factor for such a case as outlined above would be 100%. As the electric space heaters are the only means for heating the houses and as the full loads would be necessary during the cold weather to warm the houses, a demand factor lower than 100% would not be feasible. For at any time when the safe carrying capacities of the wire were exceeded the insulation on the conductors would be irreparably damaged.

Range Service

Q. In our locality the light company will permit the range circuit of 3 No. 6 wires to be taken right from the main switch. This switch is fused with a 60 amp. fuse. In this case the range has no sub-main fuse. What is your answer to a case like this?"—L.P.E.

A. We understand that what our correspondent means is that there is a main service fused switch with 60 amp. service fuses supplying, of course, both the house load and the range but that while the lighting circuits are taken from a panel with branch circuit fuses, the range circuit is taken directly from the fused service switch without a separate range fuse.

In this case the service fuse serves both as the service fuse and the range

IS THIS

FEATURE

ON THE TIME-SWITCH YOU NOW BUY?



AN ASTRONOMIC DIAL
PROVIDING COMPLETE
AUTOMATIC PERFORMANCE
BY CHANGING THE "ON"
AND "OFF" OPERATIONS IN
ACCORDANCE WITH SUNSET
AND SUNRISE...



OPERATING in accordance with sunset and sunrise, Sangamo Astronomic Dial Time-Switches are the last word in modern convenience. They require no resetting the year around. Their special feature of permitting automatic operation in accord-

ance with sun-time and the "off" operation at any time between 9:30 P. M. and 2:15 A. M. enables added operating economies. Thus, for but a few dollars more, this time-switch pays daily dividends in completely automatic, accurate, and dependable performance.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

TO THE CONTRACTOR WHO NEEDS TO CUT HIS COSTS

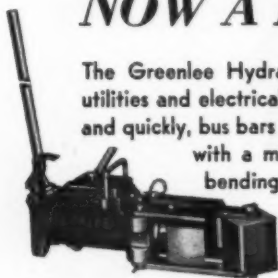


The Greenlee No. 770 Bender shown above has a maximum pressure of 25-tons for bending conduit from 1¼ to 3-inch size. For bending the larger 3 to 4½-inch conduit, requiring more power, the No. 775 Bender has a maximum pressure of 40-tons. Built compactly into one unit, these benders are easily carried to the job and set up and will not move and twist about when in use. An electric power unit can easily be attached.

GREENLEE Hydraulic Benders Can Save You 15 to 75% On Bending Costs

To bend conduit requires power . . . approximately 31 tons for 4-inch conduit . . . and the Greenlee Hydraulic Benders have power—40 tons of easily developed power in the No. 775 Bender and 25 tons in the No. 770 Bender. This power makes bending so fast and easy for the man on the job that you can save enough on labor costs alone on the first few jobs to more than pay for the bender. Many contractors have said that the Greenlee Bender has lowered labor and material costs anywhere from 15 to 75%. Write for more information and Catalog 31E.

NOW A BUS-BAR BENDER!



The Greenlee Hydraulic Bus-Bar Bender, now ready for the power utilities and electrical contractors, has been developed to bend, easily and quickly, bus bars up to 4" wide and ¾" thick, and to make U-bends with a minimum inside width of 3½ inches. The bus-bar bending attachment can be purchased separately to be used on the regular Greenlee No. 770 Power Unit or as a complete machine with power unit and attachment together.

Write for More Information Today!

GREENLEE TOOL CO.

1708 COLUMBIA AVENUE

ROCKFORD, ILLINOIS

*Questions
ON THE CODE*

[FROM PAGE 54]

circuit fuse. Such an arrangement is permissible providing two conditions are met.

First, as the range circuit wires are No. 6 the fuse must not exceed 50 amperes.

Second, in order to comply with paragraph 4247a2 or b3, which requires that the range be protected by a fuse (or circuit breaker) not exceeding 150 per cent of the rating of the range, the range, therefore, to be protected by a 50 amp. fuse must have a rating of not less than 33 amperes, or, if the range has a rating of less than 33 amperes the fuse size must be reduced. (For instance for a 20 ampere range the fuse would have to be not larger than 30 amperes.)

It will thus be seen that the arrangement is a poor one and that the range should have its own fuse of appropriate size. Also why take the necessity of having the range blow the service fuse in case of trouble when it could just as well blow its own smaller fuse and thus not put all of the lights in the house out to keep it company in its misery?

A Correction

Q. "In June 1939 'Questions on Code' Rural Hookup, you say the diagram illustrated is O.K.

"If you wire this way you have to wire the three point switches with 2 line wires into each switch, the switch loop wire going from each switch to the light. The way I understand the Code, the hot wire has to go to center of socket. This hookup does not do that as one switch will make the center contact hot and the other switch will make the shell of socket hot."—W.C.B.

A. The diagram shown in the June 1939 issue under a "Rural Hookup" was not intended to show a correct method of wiring. It was the diagram sent in by our inquirer and as indicated in our answer, it was incorrect in several ways.

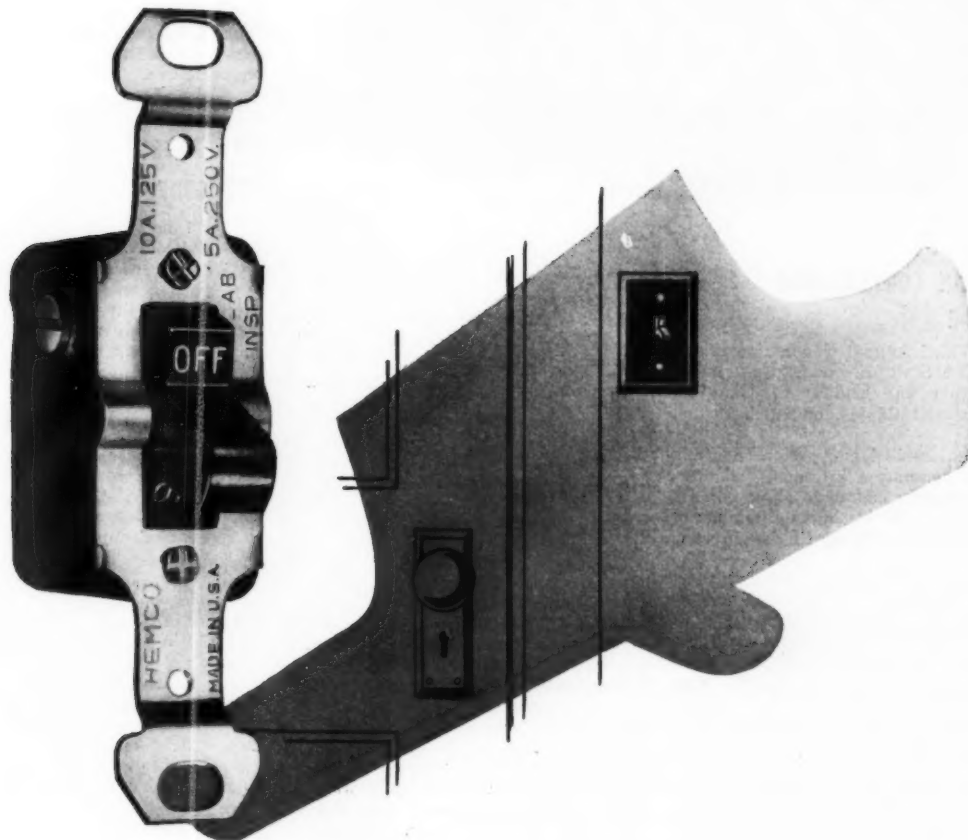
We should however have mentioned the incorrectness of the method of connecting the 3-way switches. At least another wire would be necessary and the fuse would have to be reduced from a 20 amp. to a 15 amp. one.

But if it was desired to have a 20 ampere feed line running to the barn, then it would be necessary to have 3 wires for the yard light, on account of the 3-way switching, and also a pair of No. 12 wires or 5 wires in all.

Electrical Contracting, June 1940

EVERY OUTLET DESERVES

A BRYANT DEVICE



Flush SWITCHES



Make doubly sure of getting the right switch for every job by specifying Bryant Switches. First, because these switches are made in twelve different types. Second, because the Bryant Catalog groups them according to usage. All are outstanding values, from the small home switch which sells for around a dime, to the heavy duty industrial switches priced near a dollar. For superior performance specify Bryant Superior Wiring Devices for every need.

*The Bryant Electric Company
Bridgeport, Connecticut*



SOLD THROUGH ELECTRICAL WHOLESALERS NATIONALLY

THERE IS A BRYANT DEVICE FOR EVERY WIRING NEED

In the News

MICHIGAN CONTRACTORS CONVENE

The Third Annual Convention of the Wolverine State Electrical Contractors Association was held at the Pantlind Hotel, Grand Rapids, on April 19 and 20.

W. G. Campbell, convention chairman and his committee arranged an interesting program including a joint dinner meeting with the Michigan Illuminating Society and the Grand Rapids Electric Club.

Technical addresses included "Fluorescent Lighting Comes of Age" presented by Oscar P. Cleaver, Illuminating Engineer, Westinghouse Electric Mfg. Co., Bloomfield, N. J. A Penn Denton, Consulting Engineer, New York City, spoke on the subject "1940 Code Changes in Building Wire As They Affect Its Use in Rigid Conduit."

At the Board of Governors session, the following officers were elected for the coming year: Francis J. Groleau, Muskegon, president; Arthur VanVliet, Detroit, vice-president; L. M. Richards, Lansing, vice-president; William Bat-

son, Ionia, treasurer. New Executive Committee members include: Francis J. Groleau, Muskegon; Arthur VanVliet, Detroit; L. M. Richards, Lansing; Pat Knudstrup, Manistee; Walter Apps, Roseville and W. G. Campbell, Grand Rapids.

N.C. CONTRACTORS MEET AT GREENSBORO

The annual meeting of the North Carolina Association of Electrical Contractors was held at the O'Henry Hotel in Greensboro, N. C., on May 2, 1940. Nearly 200 electrical men from over the state were present. The speakers included C. E. Swartzbaugh, president, National Electrical Manufacturers Association; L. W. Davis, general manager, National Electrical Contractors Association; H. M. Horton, illuminating engineer, General Electric Company, Atlanta; R. W. E. Moore, National Electric Products Corporation, Pittsburgh; N. E. Cannady, state electrical engineer, Raleigh; Roy A. Palmer, illuminating engineer, Duke Power Company, Charlotte; and Frank Hartis, mem-

ber of the State Board of Examiners of Electrical Contractors, Durham.

The following officers were elected for the coming year: Ralph K. Robinson, Charlotte, president; E. C. Peele, Burlington, vice-president; D. J. Thompson, Raleigh, treasurer; Frank Hartis, Durham, secretary; and Leon Kite, Charlotte, field representative.

NFPA ADOPTS NEW CODE

The National Fire Protection Association adopted the new 1940 edition of the National Electrical Code at the 44th annual meeting of the association held at Atlantic City May 7 to 11th.

Franklin Wentworth, chairman of the Association Committee on Laws and Ordinances, submitted suggestions for legislation to cover a proposed electrical inspection law based on a draft prepared by a special committee headed by L. P. Dendel of Lansing, Mich. This committee, appointed at the request of the Fire Marshals Section of the Association, drafted a model law designed to put the National Electrical Code into effective operation.

The proposed law sets up an electrical administrative board representing the various groups most directly concerned, provides for state-wide inspection by qualified electrical inspectors and makes it unlawful to supply current to an installation without a connection permit. This law is the result of an attempt to set up some type of suitable inspection procedure, the need for which has become acute with the widespread construction of electric lines in rural areas not previously served, where there have been no existing inspection facilities.

The reports of the committees on Signaling Systems and Thermostats and Air Conditioning were adopted without change.



SNAP SHOTS AT NISA CONVENTION IN DETROIT—(1) R. M. Colman and W. J. Wheeler, The Maintenance Company, New York and Charles C. French, French Gerleman Electric Co., St. Louis. (2) H. E. Grant, Tennessee Electric Motor Service Co., Nashville and C. W. Nunn, Swanson Nunn Electric Co., Evansville. (3) Frank Willey, Willey-Wray Electric Co., Cincinnati; Arthur Wagner, Arthur Wagner Electric Co., Chicago and Roland B. Glines, Lawrence. (4) New officers, C. A. Sievert, Sievert Electric Co., Chicago, president; L. Bonnezaze, Best Electric Co., New Orleans, vice-president; Andy Brown, Alfred L. Brown Associates, Worcester, treasurer and C. J. Cannon, Neimmo Electric Co., Detroit, secretary. (5) C. A. Sievert, Sievert Electric Co. of Chicago with retiring president J. M. Pilmer, Electrical Engineering & Construction Co., Des Moines. (6) A. E. Vaughn, Sievert Electric Co., Chicago and E. C. W. Johnson, Scherer Electric Co., Indianapolis.

*a Note to
Electrical
Contractors*



As an integral part of the basic design of Westinghouse Fluorescent Luminaires, low installation costs are considered as important as low unit costs. For example, in the R.L.M., Open End and Continuous Duct units, installations are extremely simple. Hoods may be separated from reflectors to remove knockouts and mount on conduits or chains. Safety type hook-on hinges attach the reflector to the hood, and will not become unfastened unless lifted completely free.



Wiring costs are also low. Auxiliaries in each unit are completely wired and, while reflector safely hangs in open position, line conductors are quickly spliced to fixture leads and the reflector locked to the hood.



The lamps are then quickly inserted in the reflector and the unit is ready for use.

THE BIGGEST NEWS IN INDUSTRY IS FLUORESCENT LIGHTING



IN ONE SHORT YEAR there has been a virtual revolution in Industrial Lighting... in many instances a complete overthrow of accepted standards in lighting effectiveness.

Today all eyes—the eyes of management, of executives, of operating personnel—are focused on Fluorescent Lighting... because this new and more efficient mode of lighting now makes it economically practical to obtain the higher levels of illumination so necessary in industry.

Westinghouse Fluorescent Luminaires, with porcelain enamel or Alzak aluminum reflectors, give twice as much light... without glare or shadow, and are 50% cooler... permitting closer placement to light-demanding tasks.

Westinghouse, a pioneer in all forms of lighting, now makes it easy for Electrical Contractors to provide the benefits of this new kind of illumination. Local stocks of Westinghouse Fluorescent equipment are available nationally through 117 Westinghouse Electric Supply Company Offices or Independent Westinghouse Lighting Distributors—for any installation, large or small. A complete 32-page technical Guide to Fluorescent Lighting—B-2235—is yours for the asking. Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

Westinghouse FLUORESCENT LIGHTING





[FROM PAGE 60]

The standard for Air Conditioning, as adopted, recommends the use of photo-electric devices for detecting smoke in air conditioning equipment.

Alvah Small, president of Underwriters' Laboratories, Inc., Chicago, was elected president of the National Fire Protection Association.

ADEQUATE WIRING ACTIVITIES

Increased activity on all fronts might well describe the briskness of the Adequate Wiring Program of the National Bureau throughout the country. Here's what's happening in some of the Bureau's outposts.

Muskegon, Mich.—The recently organized Muskegon Adequate Wiring Bureau received a license to operate the certification plan in the city of Muskegon and in certain portions of Muskegon, Newaygo and Ottawa Counties, Mich. This is the second certifying area in that state. Grand Rapids is the other.

Peoria, Ill.—The Adequate Wiring Committee of Peoria received a license to operate the certification plan in that city and in certain portions of Fulton, Knox, Mason, Peoria, Tazewell and Woodford Counties, Ill.

Charleston, W. Va.—The Electric League of Charleston, W. Va., received a license to certify residential wiring installations in Kanawha County. At the begin-



NEW OFFICERS of North Carolina Association of Electrical Contractors, left to right: Leon Kite, field representative; E. C. Peele, vice president; Ralph K. Robinson, president; Frank Hartis, secretary.

ning it will be operative in Charleston, South Charleston, Dunbar, Clendenin and St. Albans.

Salt Lake City, Utah—The Electrical League of Utah has started construction of an all-electric home to emphasize the importance of adequate wiring, modern electric kitchens and complete electrical service.

Milwaukee, Wis.—Approximately 200,000 persons visited the annual Home Show and saw the display of the Electric League of Milwaukee demonstrating the difference between adequate and inadequate wiring. A feature of the Show was the certified AW home which was given away.

Provo, Utah—The Electrical League of Utah presented the first certificate of adequate wiring issued in this city to Clyde T. Crockett. Peck Electric Company of Provo were the electrical contractors.

Dallas, Tex.—The Dallas Adequate Wiring Committee promoted adequate wiring through a demonstration panel and exhibit at the local Home Show held the week of April 21-25.

Chattanooga, Tenn.—The Electric League of Chattanooga announced that the first adequate wiring certificate for an all-electric home has recently been issued. V. E. Clark was the electrical contractor.

Benton Harbor, Mich.—A temporary committee, headed by Carl Naren, Indiana & Michigan Electric Co., and consisting of seven contractors, two utility representatives, one jobber and one inspector, has been formed in this district to work out details for forming an Adequate Wiring Bureau.

Trenton, N. J.—The Central Jersey Electrical League announces a series of programs for women's clubs, consisting of the films, "Power for Living" and "Getting the Most out of Electricity Safely."

A display dramatizing the typical materials used by Central Jersey contractors in home adequate wiring installations was a feature in Trenton's Electric Gas and Appliance Show, presented by the Central Jersey Electrical League on May 6 to 9. The display drew many inquires from the 5,800 consumers who attended the show.

Pennsylvania—The West Penn Power Company recently concluded a series of six divisional meetings designed to increase residential wiring adequacy throughout the 35 districts and 12 sub-districts it serves. This was the opening gun of a well organized extensive sales training program to expand and round out the activity to attack all markets.

Providence, R. I.—Electrical League of Rhode Island sponsored an adequate wiring display at the Rhode Island Housing Exposition held May 6 to 11. Electrical contractor members of the League manned the display which was viewed by more than 15,000 visitors.

Denver, Col.—Rocky Mountain Electrical League announces a prize con-



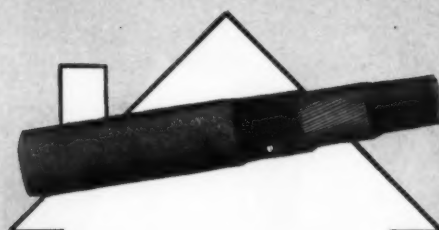
"Scram—I was here first!"



STYLE ABN

(ARMORED BARE NEUTRAL)

makes possible low cost service entrances because cable may be strapped to the house. No conduit is required. Style ABN is manufactured with a flat galvanized steel tape applied with a minimum spacing to resist mechanical injury and prevent damage by rodents.



STYLE UBN

(UNARMORED BARE NEUTRAL)

made without the steel armor of Style ABN, this cable is provided with a heavier double wrapped tape cushion underneath the outer braid and the concentric conductor contains a greater number of wires wrapped more closely, thereby making it diversion proof.

Eliminate Bottlenecks

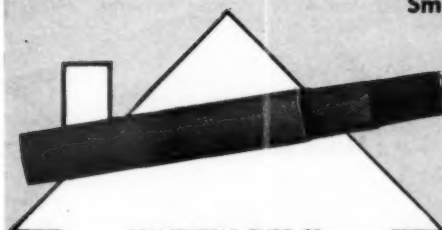
with HAZARD

SERVICE ENTRANCE CABLES

and

HAZAKROME Type SN

Small Diameter Building Wire



CONCENTRIC TYPE SD DROP CABLE

combines the advantages of small dimensions, light weight and efficiency. Can be used to carry entrance circuit from pole to house Entrance Cable or by use of single hole entrance cap and rigid conduit it may be continued to meter or entrance switch. Supplied in two or three conductor constructions.



ARMORED SERVICE ENTRANCE CABLE

consists of two or three Hazard submarine rubber insulated and braided or taped conductors protected against moisture and mechanical injury by multiple layers of pre-saturated jute, non-metallic armor tape and plastic sealing compound. Hazard Armortite Cable is light in weight, easy to handle and moderate in cost.

Write today for

HAZAKROME HANDBOOK

It tells how to use, install and sell HAZAKROME Type SN for rewiring existing raceways to obtain increased circuit capacities.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.

WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta

Dallas Washington Cleveland



Pittsburgh Buffalo Boston Detroit Seattle

San Francisco St. Louis Los Angeles



MODERN SERVICE STATIONS NEED MONOTUBE Steel Poles

FLOODLIGHTING should do a two-way job for the modern service station. One—provide adequate illumination to attract sales after sundown. Two—present an attractive daytime appearance which will blend—not clash—with today's streamlined architecture.

Union Metal Monotubes are designed to meet the height and strength requirements prescribed for efficient floodlighting. The beauty of these fluted or round tapered steel poles is always in harmony with their modern surroundings. And their all-steel construction insures long pole life with minimum maintenance.

The Monotube line is complete. Floodlighting poles of one-piece or hinged design—combination sign and floodlighting poles—pump island and area lighting poles—all are available in a size and construction to meet every service station need. Write today for FREE catalog.



Send me copy of your Catalog No. 70 describing Union Metal Monotube Floodlighting Poles.

Name _____

Company _____ Title _____

Address _____

City _____ State _____

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

In the News

[FROM PAGE 42]

test for the best slogan or phrase descriptive of the economies, conveniences and safety of adequate wiring. Cash prizes will be awarded.

Sheboygan, Wis. — Adequate Wiring Bureau of Sheboygan was recently granted a license to operate the Certification Plan of the NAWB in the city and county of Sheboygan.

New Orleans, La.—Electrical Association of New Orleans recently received a license to supervise the certification of adequate wiring within the city limits. This is the 37th city to inaugurate the certification plan.

St. Louis, Mo. — Adequate Wiring Bureau of the St. Louis Electrical Board of Trade reveals that during the first nine months of its initial year of operation, 151 sets of plans were corrected. Of a total of 37,399 additional outlets recommended, 18,400 were actually added or are now being added in addition to increased capacity and proper wire sizes.

Minneapolis, Minn. — Minnesota Adequate Wiring Certification Plan is the first approved for a state-wide operation by the National Adequate Wiring Bureau. When the present schedule of meetings is completed, the certification plan will have been presented in areas representing more than 80 per cent of the wired homes in the state.

COUNCIL ARBITRATES AKRON DISPUTE

On May 3, 1940 the Council on Industrial Relations for the Electrical Construction Industry, representing the IBEW Employers Section of NECA and the International Brotherhood of Electrical Workers, met in Washington for the arbitration of a dispute submitted by mutual agreement of the Akron, Ohio, electrical contractors and Local Union B-306 IBEW of that city, regarding a demand for an increase in the wage scale made by the local union.

In submitting its decision that the standard rate of wages in Akron effective as of June 1, 1940 shall be \$1.35 per hour, the Council by unanimous action strongly recommended that the parties to the dispute mutually agree upon an economic rate for residential work below the standard rate fixed by the agreement, and pointed out that such rates have been adopted in many localities. In making this recommendation the Council stated:

"If the wage is too high the volume of work shrinks; if the wage is too low quality of work declines.

"The job of the Council is to find a proper mean, and therefore an economic mean, between those extremes. The question is not what the worker is entitled to, but rather what wage will make the maximum contribution to the workers' annual income; and the annual income is more dependent on continuous volume, on rising volume, than on the hourly wage."

THE WORLD'S FINEST FLUORESCENT LUMINAIRES

SKYLUX

PATENTS APPLIED FOR

STANDARD FIXTURES FOR
General Fluorescent Lighting

ENGINEERED FOR HIGHEST EFFICIENCY
Here are a few of the reasons why SkyLux tops the field in fluorescent lighting: 1. More light on the working plane for the number of lamps used. 2. Installation can be made from present outlets as a single fixture or in long lines of light, either flush with ceiling or suspended from hangers. 3. Single

fixtures can be easily converted at any time into continuous lines of light without expense of replacing original equipment. 4. Where lighting equipment budgets are limited, the "add-a-unit" feature makes your selling easier because intensities can be raised as needed by simply adding additional SkyLux fixtures. • It will pay you to recommend and install SkyLux both from your profit standpoint and the consumer's satisfaction. • Write today for the SkyLux catalog and learn all the facts about the world's finest fluorescent luminaires.

PATENTS
APPLIED
FOR



TWO SECTION TWIN SKYLUX

1. FLURACITE REFLECTOR
2. LAMP SHIELD
3. FLUORESCENT LAMP
(Not supplied)

SkyLux **HAS SHIELDED LAMPS**

SkyLux Fluorescent Luminaires not only bear the Fluor-o-Lier official label but meet this all important specification laid down by the Fluor-o-Lier Manufacturers . . . "Fluorescent lighting fixtures employing existing types of lamps are not recommended for schools, offices and similar locations unless lamps are shielded from direct view."

PATENTS
APPLIED
FOR



TWO SECTION SINGLE SKYLUX

1. FLURACITE REFLECTOR
2. LAMP SHIELD
3. FLUORESCENT LAMP
(Not supplied)

Curtis Lighting

NEW YORK

1123 West Jackson Blvd. • CHICAGO

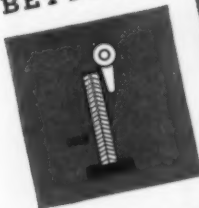
TORONTO

GET

BI-METAL



HERE'S HOW BI-METAL
SAVES MONEY... GIVES
BETTER PROTECTION



Two different metals bonded together, when heated always bend in the same direction. The heat from short circuit or direction. The heat from short circuit or continued overload currents causes the Bi-Metal, which is exactly calibrated to the job at the factory, to act and open the circuit. Because of Bi-Metal's characteristics, its accuracy never changes, regardless of the number of operations. There's nothing to replace... nothing to wear out.

ASK YOUR WESTINGHOUSE REPRESENTATIVE
FOR THIS BI-METAL DEMONSTRATION

MAKE THIS TEST YOURSELF... A strip of Bi-Metal and a match are all you need to prove to yourself the time and money-saving advantages of Bi-Metal Protection. Ask your Westinghouse Representative for a Bi-Metal Demonstration Kit.



YOU PAY NO MORE FOR BI-METAL PROTECTION
IN THIS WESTINGHOUSE EQUIPMENT

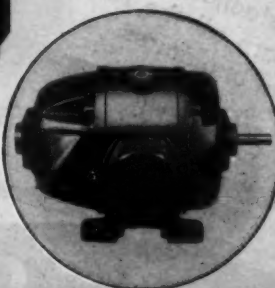


NO-FUSE CIRCUIT
BREAKER

Bi-Metal eliminates fuses. "De-ion" arc quenchers save contacts.

THERMOGUARD
MOTOR

Single-phase sizes up through 2 hp. Impossible to burn out. Bi-Metal protection.



LIGHTING AND POWER
PANELBOARDS

Bi-Metal protects circuits. Eliminates fuses. "De-ion" arc quenchers save contacts. Tamper-proof.

Westinghouse



OVERLOAD PROTECTION *in the Starter*

PROTECT THE MOTOR FROM OVERLOAD

The Bi-Metal unit in the Westinghouse "De-ion" Linestarter gives dependable, consistent motor overload protection. The Bi-Metal relay is accurately calibrated at the factory. It maintains this accuracy unchanged even after repeated operation. Before the heat of an unsafe overload can damage motor windings, the Bi-Metal operates automatically to disconnect the motor from the line. There is nothing to renew or replace. You save time, trouble and money.

In addition to Bi-Metal protection, you get the exclusive "De-ion" Arc Quenchers that protect the starter itself. "De-ion" Arc Quenchers draw the arc into grids, quench it instantly, prevent flashover, protect contacts from beading or pitting, reduce maintenance cost.

Get trouble-free starter performance . . . specify Westinghouse "De-ion" Linestarters. Ask your nearest Westinghouse wholesaler, district office, or industrial agent.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.



"DE-ION" LINESTARTER

Magnetic Linestarter . . . can be operated either by a built-in or separately mounted pushbutton, or by float or pressure switch.

★

EXCLUSIVE "DE-ION" ARC QUENCHERS

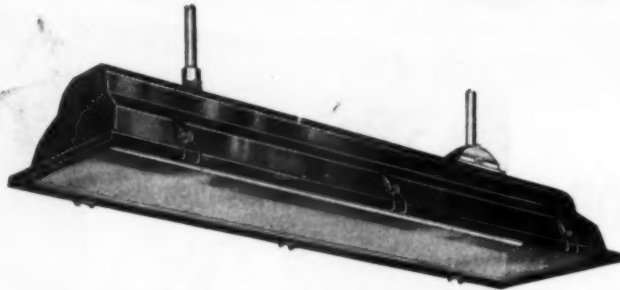
SEE how "De-ion" Arc Quenchers draw the arc into grids, breaking it up, quenching it instantly.



J-90338

Motors and Control

THE NEW WHEELER VAPOR-PROOF FLUORESCENT LIGHTING UNITS



Wheeler VAPOR-PROOF Fluorescent Units are made for use in food plants, foundries, and similar locations where it is necessary to protect lamps, sockets and reflecting surfaces from moisture, dust, smoke and vapors.

In locations such as food plants where it is desirable to take extra precaution against lamp breakage, it is recommended that these units be equipped with safety sheet glass covers for maximum protection.

When used with the "Daylight" Fluorescent lamp, these new units provide a cool, efficient, color-corrected Daylight quality illumination which tends to reduce spoilage and rejects. Units are easy to install and easy to service.

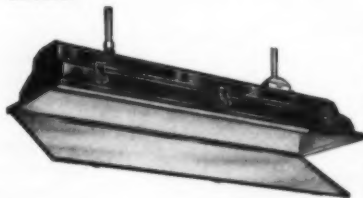
The entire outer body of the reflector, including its closed ends, is enameled in one piece. All sockets and lamp operating equipment are mounted on a wiring channel which is installed through the mouth of the reflector.

The mouth of the reflector has a recessed flange to receive the hinged glass cover which seats against cushioning gaskets to form a moisture and dust-proof seal.

All units are supplied complete with the latest type of ballast equipment employing separate and renewable starter switches. Two lamp fixtures are supplied with high power factor Tulamp ballasts resulting in an overall power factor above 95% and greatly minimizing any stroboscopic effect. A starting compensator is included in all two lamp units.

Capacitors for power factor correction can be supplied on all single lamp units.

Fixtures are furnished *wired*, with pigtails left for connecting to branch circuit.



HINGED DUSTTIGHT GLASS COVER

The Hinged Dusttight Glass Cover is readily opened for access to lamps or starter switches by releasing toggle latches. Units can be supplied with $\frac{1}{4}$ " Water White Plate Glass, $\frac{1}{4}$ " Tempered, Clear Safety Plate Glass or with $\frac{1}{4}$ " Double-thick Plain Clear Glass.

For complete data write for New Bulletin No. 60-A

Distributed Exclusively Through Electrical Wholesalers

WHEELER REFLECTOR COMPANY

275 CONGRESS ST., BOSTON, MASS.

NEW YORK

ATLANTA

CLEVELAND

In the News

[FROM PAGE 64]

E.M.E. SHOW AT MILWAUKEE

The first Industrial Electrical Exposition staged by the Electrical Maintenance Engineers of Milwaukee was held in the Public Service Building Auditorium in Milwaukee April 19-20. Scheduled to become an annual event, the electrical show had 34 exhibitors and attracted approximately 700 electrical maintenance engineers, electrical contractors, utility men and others interested in industrial electrical products from the eastern Wisconsin industrial area.

The E.M.E. conference held Saturday, April 20, was addressed by M. R. Ely, secretary of the Chicago E.M.E. organization; I. L. Illing, Wisconsin Electric Power Co.; George Andrae, Herman Andrae Electric Co.; O. M. Ward, Wisconsin Electric Power Co.; F. M. Blum, Harnischfeger Corp.; LeRoy F. Keely, Louis-Allis Co.; T. B. Harwood, Cutler-Hammer Inc., and William Siebenmorgan, Speer Carbon Co.

CONFERENCE OF NECA CHAIRMEN

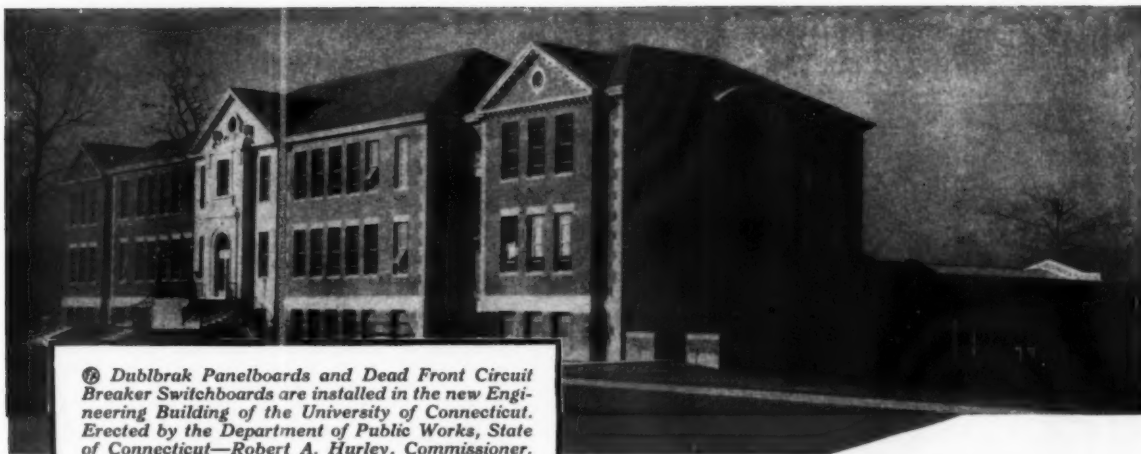
A conference of the chairmen of the five major standing committees of NECA with President McChesney and the General Manager, will be held at Lake Placid, New York, on June 16th to 19th, on the occasion of the annual convention of the New York State Association of Electrical Contractors and Dealers at that place.

The following committee chairmen will be present: D. B. Clayton, Sales Development Committee, Birmingham; A. Lincoln Bush, Statistical Surveys Committee, New York City; George Andrae, Codes & Standards Committee, Milwaukee; Geo. W. Patterson, Estimating & Cost Data Committee, Toronto; and E. C. Carlson, Labor Relations Committee, Youngstown.

WIRING HANDBOOK TO BE REVISED

The Handbook of Interior Wiring Design will be completely revised during the current year by the Industry Committee on Interior Wiring Design. The revision will include advances in wiring design practice since 1937 as well as changes made necessary in basic design considerations due to the important revisions forthcoming in the 1940 edition of the National Electrical Code.

The work will be handled by a Technical Subcommittee of which R. G. Slauer, Westinghouse Electric & Mfg. Co., is chairman. Other members of this committee are: A. B. Smith, National Electrical Manufacturers Association; Allan Coggeshall, Hatzel and Buehler; M. S. MacNaught, *Electrical Contracting*; G. S. Merrill, General



Ⓕ *Dublbrak Panelboards and Dead Front Circuit Breaker Switchboards are installed in the new Engineering Building of the University of Connecticut. Erected by the Department of Public Works, State of Connecticut—Robert A. Hurley, Commissioner.*

Ⓕ **BRANCH CIRCUIT BREAKER CONTROLS REQUIRE 33 $\frac{1}{3}$ % LESS SPACE...**

than is needed for switch and fuse type branches



THAT means 50 per cent more circuits in the same cabinet space. And the question of space must be considered in new construction as well as modernization. In modernization this is extremely important, because the new thin-wall wiring greatly increases the circuit requirements.

Both the Ⓕ Type AC Circuit Breaker and the Ⓕ Dublbrak Circuit Breaker are but one inch in width. This makes possible the larger number of circuits in the space required for the old-type cabinet, and eliminates the expense of tearing the old box from the wall.

Then, too, due to complete standardization, the units are interchangeable as to capacity. They are manufactured on a quantity basis, and so are priced reasonably. Above all, *they afford modern protection.*

Ⓕ **Circuit Breaker Type Standard Panelboards**

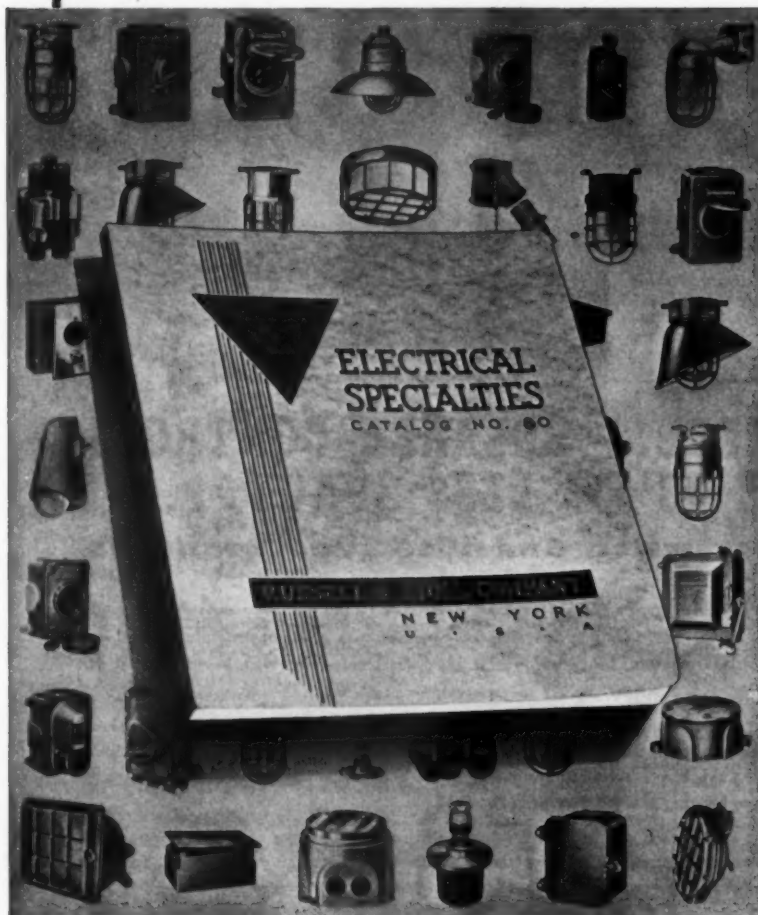
—like all other Ⓕ Products— are built better than necessary. They are designed to be ornamental, as well as practical. Immediate delivery of many styles and capacities may be had from the stocks of wholesalers, and those of our various sales representatives.

Let the Nearest Ⓕ Sales-Engineer Help You

Make it a practice to consult with him. The benefits of his long and specialized experience are yours for the asking. If you do not know where to find him, write us for his name and address... and ask for new Catalog No. 56... Frank Adam Electric Company, St. Louis, Mo.



NOW BEING MAILED



FITTINGS to FIT your CONDITIONS

Water-Tight • Explosion-Proof • Weather-Tight

Completely revised 256-page catalog (just off the press) listing

1. Many newly-developed products
2. Tables of useful information
3. Application and installation data
4. Dimension drawings of important items
5. NEW LOW PRICES

If you have not written for your copy—be sure to do so at once.

RUSSELL & STOLL COMPANY
(AND SUBSIDIARY, FEEDRAIL CORPORATION)

150 Park Place

New York, N. Y.

RUSSELL & STOLL
COMPANY
150 PARK PLACE,
NEW YORK, N. Y.

Send copy of new R & S Catalog to

Mr.
Title.....
Company ..
Address ..

In the News

[FROM PAGE 48]

Electric Co.; F. N. M. Squires, N. Y. Board of Fire Underwriters; Howard Stevenson, Detroit Edison Co. and W. S. Stewman, New York Power and Light Corporation.

Mr. Slauer would like to receive suggestions, comments and criticisms regarding the Handbook text, material covered and method of presentation from anyone interested. All suggestions should be sent to R. G. Slauer, Westinghouse Electric & Mfg. Co., 150 Broadway, New York, N. Y.

COMING MEETINGS

New York State Association of Electrical Contractors and Dealers—Annual Convention, Lake Placid Club, Lake Placid, N. Y., June 17-20.

International Association of Electrical Inspectors—Southwestern Section, Santa Barbara, Calif., August 26-30. Northwestern Section, Great Falls, Mont., Sept. 3-6. Southern Section, Houston, Texas, Sept. 16-20. Western Section, Kansas City, Mo., Sept. 23-27; Eastern Section, New York, N. Y., Oct. 7-11.

National Electrical Contractors Assn.—Annual Convention, George Washington Hotel, Jacksonville, Fla., Oct. 21-23.

National Electrical Manufacturers Assn.—Annual Conference, Waldorf-Astoria Hotel, New York, N. Y., Oct. 27 to Nov. 1.

ILLINOIS TAX RULING CLEARED

Principles governing the Illinois retailers' occupational tax pertaining to interstate shipments was revised on April 1 according to an announcement by the Electrical Contractors Association of Chicago.

1. Where the property is within the state and, as a part of the sale, does not leave the state, the tax applies, irrespective of where the parties are located or where the contract was made. It is immaterial that the purchaser may, subsequent to the sale, transport the property out of the state.

2. The tax does not extend to sales in which the seller makes delivery from a point in the state to a point outside the state, not to be returned to the state. It is immaterial whether the goods are sold f.o.b. origin or f.o.b. destination.

3. Tax liability is incurred when sales at retail are made in the state even though the property sold is transported directly to the buyer from a point outside the state, whenever the seller is engaged in the business of selling in the state, and whenever possession is transferred to the buyer in Illinois. It is immaterial whether the purchase precedes or follows the interstate shipment or is made f.o.b. point of origin or f.o.b. destination.

Contracts purporting to require shipment from points outside of Illinois or transfers of possession outside of Illinois will not exempt sellers where the tax would otherwise apply.

The Rewiring Market Is Opening

USE FLAMENOL

Reg. U. S. Pat. Off.

SMALL DIAMETER BUILDING WIRE

(For Rewiring Existing Raceways)

Rewiring jobs used to be hard to get because of the expense involved. But that isn't true any longer. Rewiring with Flamenol Small Diameter Building Wire is inexpensive. New raceways aren't required. Simply replace the wires in existing conduits with more or larger capacity Flamenol Building Wires.

Buildings which need rewiring are everywhere about you—stores, office buildings, apartment houses, factories, schools, hospitals. The wiring in buildings only a few years old isn't adequate to supply modern wattage needs—for today's high intensity lighting—for today's electrical equipment. With Flamenol Building Wire you have a story to tell that should help you to get one rewiring job after another.

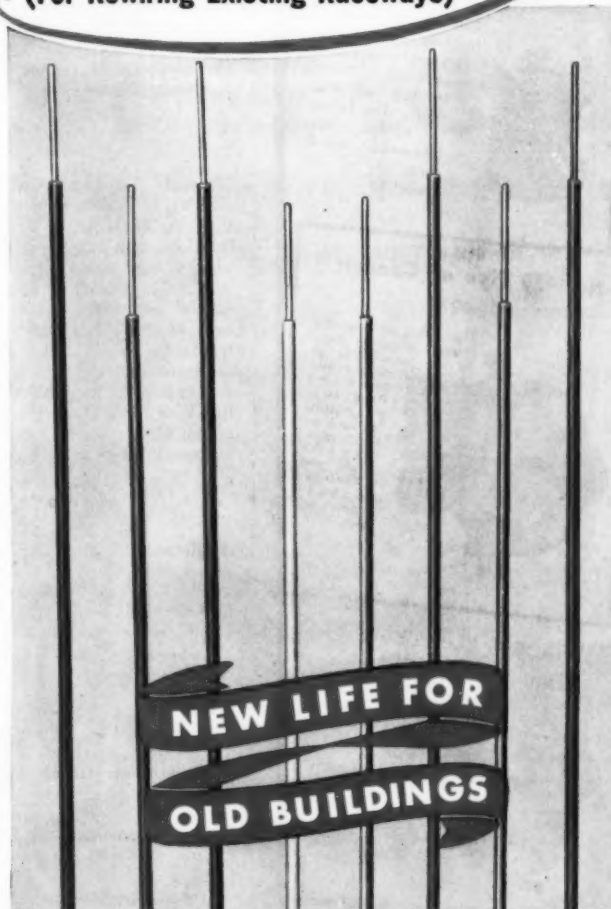
SIZES 14 TO 4/0 AVAILABLE

Whole wiring systems can be modernized with Flamenol Building Wire—feeders, subfeeders, and branch-circuits. It is available in sizes 14 to 4/0 inclusive. Flamenol Building Wire is insulated with a plasticized polyvinyl chloride compound which is a superior material for thin insulation. For instance, it does not oxidize and is practically ageless. It is inherently tough, high in dielectric strength. It resists oil, acids, alkalies, moisture and flame.

EASY TO HANDLE

Moreover, Flamenol Building Wire is easy to install because of its smooth, glossy, wax finish. It is available in a variety of bright colors which make circuit identification easy. Color goes all through the insulation. For more information about this new wire or for samples see the nearest G-E Merchandise Distributor or mail the coupon below.

Size of Conductors	Number of conductors in conduit or tubing																	
	Type R									Type SN								
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1



General Electric Company
Section WF-0126
Appliance and Merchandise Department
Bridgeport, Connecticut
Sir: Please send me
{ More information about Flamenol Building Wire
{ Samples of Flamenol Building Wire

Name _____
Address _____
City _____ State _____

COMPARISON OF WIRE DIMENSIONS

Size AWG	Approximate Over-all Diameter (in.)		Area in Square Inches	
	Rubber-covered Type R	Flamenol—Type SN	Rubber-covered Type R	Flamenol—Type SN
14 Sel.	.19	.190	.028	.0133
12 Sel.	.21	.147	.035	.0170
10 Sel.	.23	.168	.042	.0220
8 Sel.	.28	.227	.082	.0405
6 Strd.	.41	.314	.13	.0715
4 Strd.	.45	.363	.16	.1035
2 Strd.	.52	.423	.21	.1405
1 Strd.	.59	.486	.27	.1835
1/0 Strd.	.63	.537	.31	.226
2/0 Strd.	.67	.582	.36	.267
3/0 Strd.	.72	.634	.41	.316
4/0 Strd.	.78	.692	.48	.376

GENERAL ELECTRIC

FLOOR BOXES and WIRING SPECIALTIES

No. 110 "Latrobe" Watertight Box



Cut-away view showing how tapered unit receptacle fits tapered opening in top of box body. The latest in design, appearance, and simplicity of installation.

No. 470 Pipe or Conduit Hanger



Pipe support turns freely, allowing pipe to run parallel or at right angles to beam. Does away with drilling or use of straps. Handles 1/2", 3/4" and 1" size pipe, to steel beams 3/4" thick.

No. 330 "Latrobe" Tom Thumb Utility Outlet



To be used in wood installations and other locations free from moisture or mechanical injury.

• The Latrobe Line is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time . . . an important point to consider when selecting floor boxes and wiring specialties.

Write for details TODAY!
FULLMAN MFG. CO.
LATROBE • PENNA.

—WITH THE— *Manufacturers*

Cutler-Hammer Changes

O. P. Robinson has been appointed to the Pittsburgh Sales Engineering Staff. He was formerly with the company's Chicago sales office.

The Cutler-Hammer office and warehouse in Atlanta, Ga. has moved to a new location at 134 Marietta St., N. W. This office is in charge of A. C. Gibson.

G. E. Hunt has been put in charge of the Indianapolis office located at 307 N. Pennsylvania Ave.

General Electric Co., Schenectady, N. Y., announces the retirement of F. J. A. McKittrick, in charge of trade relations, on June 1, after 44 years of service with the company.

W. M. Stearns, now manager of special contracts, has been made manager of trade relations and special contracts, with W. A. Sredenschek as assistant manager. G. P. Vest will succeed Mr. Sredenschek as assistant to Vice President Shreve, assuming responsibility for the sales training and placement of technical graduates.

Appleton Electric Company, Chicago, announces that A. C. Schwager has joined its sales department in the Cleveland territory, with offices at 214 Hippodrome Bldg., Cleveland, Ohio. Mr. Schwager was formerly connected with the Graybar Electric Company, Cleveland.

Westinghouse Lamp Division, Bloomfield, N. J., has promoted Richard G. Slauer to district engineer for the Division's northeastern district. He was formerly with the commercial engineering department. Mr. Slauer will make his headquarters in New York.

Ransome Concrete Machinery Co., Dunellen, N. J., has appointed Ebbert & Kirkman Co., 321 Brown Marx Bldg., Birmingham, Ala., as sales representatives for Alabama and part of Florida west of the Apalachicola River for its line of welding tables and positioners.

The Wadsworth Electric Mfg. Co., Covington, Ky., announces the election of Edwin W. Landmeir, chief engineer, to the office of vice president.



REFRIGERATOR SERVICING AIDS

- It's easy—and mighty profitable — to service electric refrigerator capacitor-start motors the AEROVOX "Jiffy-Start" way. Here are two aids which make that possible:

CAPACITOR SELECTOR

- Most motors can be identified by make and type of refrigerator, or the motor nameplate. Refer to the AEROVOX replacement listings and you see what type capacitor to use. But . . . if you cannot identify the motor nor the capacitor, then use the Capacitor Selector. Clip in circuit. Flip the switches. Watch the voltmeter. When best starting torque is attained, within safe voltage limits and time, read the capacity required from the "On" switches. That's all there is to it.

EMERGENCY UNITS

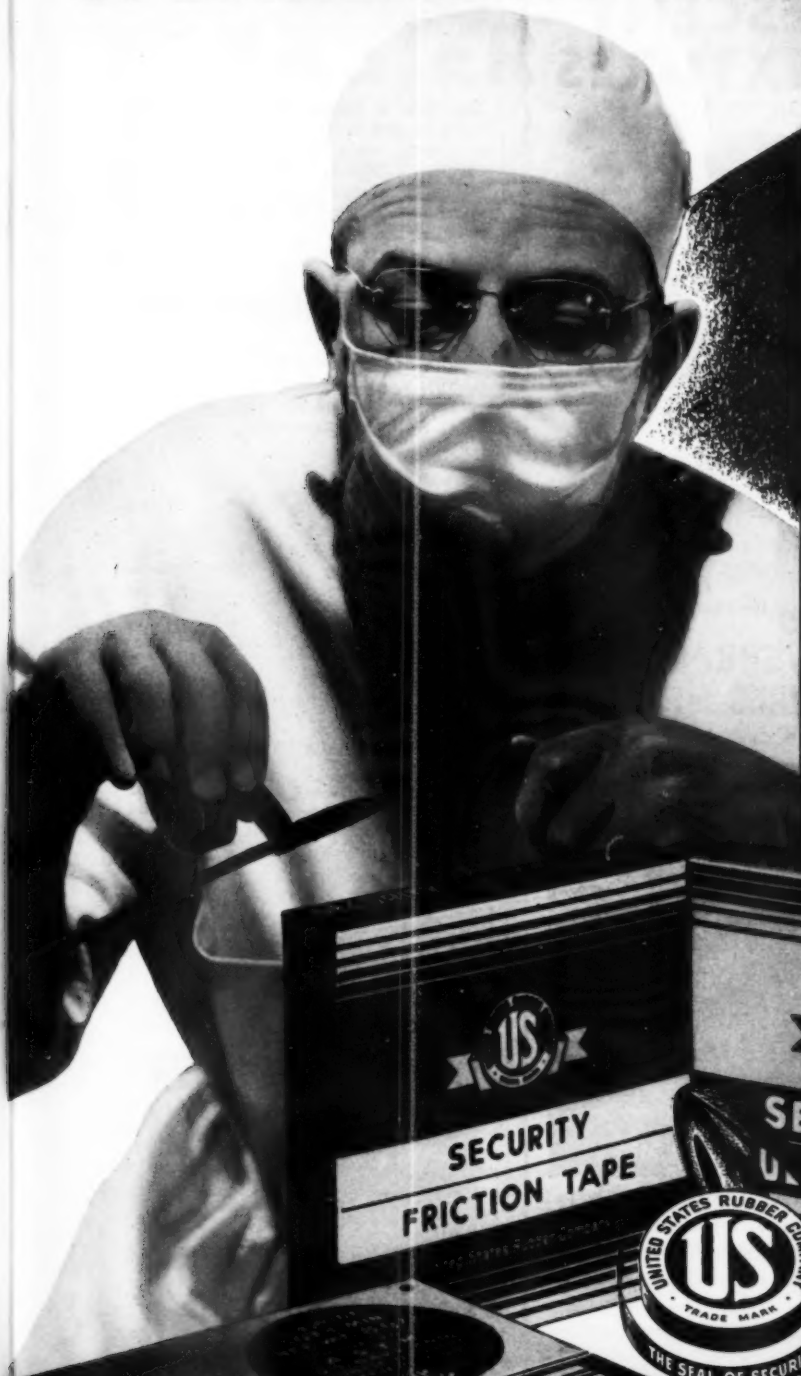
- Then, to get any capacitor-start motor going in a jiffy, use an AEROVOX Emergency Unit. Plug in required capacity values to make up required capacity, and clip in place. Presto, the motor starts up. Later, at your convenience, install a standard replacement unit, for permanent job.

Slashed Prices . . .

- Note that your net cost for the Capacitor Selector has now been reduced from \$14.75 to \$10.00. Emergency Units are now \$4.00 each instead of \$9.00. You don't have to buy a kit. Buy just what you need. Ask local jobber about these items—or write us direct for literature.

AEROVOX
CORPORATION
NEW BEDFORD, MASS.
IN CANADA: AEROVOX CANADA Limited, Hamilton, Ont.

SPECIALIST *in Wire* SURGERY!



U. S. Tapes are the *certificate* of the real wire specialist. They mean that the contractor who uses them knows his business. No matter how they're used—for splicing, wrapping or any other kind of electrical work—they're just what the specialist orders to give "Service Beyond Price and Specifications."

Order today from your wholesaler.



UNITED STATES RUBBER COMPANY
ROCKEFELLER CENTER NEW YORK CITY



FLUORESCENT LAMP FIXTURES

(SUSPENSION TYPES)

For
**GENERAL
LIGHTING**

OF
**SHOPS—
RESTAURANTS—
WAITING ROOMS—
ETC.**



No. 2024
2-Light



No. 2025
3-Light

- Attractive appearance —
- High reflecting efficiency —
- Easily wired —
- Many profitable applications —

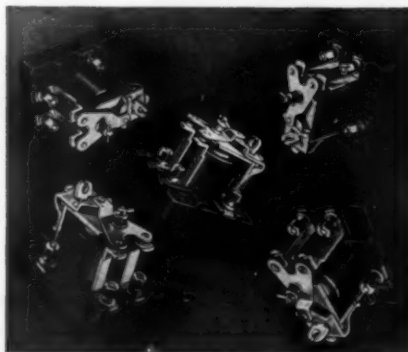
Booklet gives construction and installation details — send for it.

**OVERBACH AND
AYRES MFG. CO.**

411 S. Clinton St. Chicago, Ill.

RELAYS

viewed
from
every
angle



CRISP ACTION. The wiping action of fine silver to silver contacts keeps them clean.

DEPENDABILITY. Contacts never stick or become pitted. Hence no failure.

DURABILITY. The combination of sound design and careful construction with sturdy parts gives unusually long life.

ECONOMY. Even though the construction is sturdy, fine workmanship makes easy action without undue current consumption.

The Ward Leonard Line comprises light, intermediate and heavy duty, sensitive, time delay types for every application. Send for bulletins describing relays of interest to you.

**WARD LEONARD
ELECTRIC COMPANY**

28 SOUTH STREET

MOUNT VERNON, N. Y.

Electric Controls Since 1892



[FROM PAGE 72]

The Yale & Towne Manufacturing Co. has promoted S. W. Gibb to the position of general sales manager of the Philadelphia Division. Mr. Gibb succeeds James C. Morgan, who stepped up to the post of general manager of all Philadelphia.

The M. B. Austin Company, Chicago, at a recent meeting of its stockholders, elected the following officers—M. B. Austin, Sr., chairman of the board; M. B. Austin, Jr., president; W. W. Kingsbury, vice president and secretary; A. H. Friend, treasurer.

Ward Leonard Electric Co., Mount Vernon, New York, has opened a branch office in Baltimore, Md. Wilson K. Winbigler is in charge of the office located in the Hearst Tower Building.

Eisler Electric Corp., Union City, N. J., has changed its corporate title to Callite Tungsten Corp.

The Miller Company, Meriden, Conn., has moved its New York offices and display rooms from 14 East 38th Street to 315 Fourth Avenue.

The Essex Wire Corp., Detroit, announces the election of W. J. Shea as vice-president, in charge of its Magnet Wire Division at Fort Wayne, Ind.



INFORMATION, PLEASE—H. A. MacInnis, (second from left) Bryant representative at the Boston Trade Show explains some of the fine points of a wiring device to John E. Mitchell (extreme left), contractor of Barre, Vt.; J. B. Seamens, contractor, Concord, N. H.; E. L. Wishart, Mass. Gas & Electric Light Supply Co., Boston; and W. H. Moore, chief engineer, Dartmouth College, Hanover, N. H.

Electrical Contracting, June 1940

EASIER TO INSTALL

...easier to use!



LARGE WIRING SPACE

Type SD push button cases are small and compact, yet provide ample wiring space inside around entire button unit. Knockouts at top and bottom make wiring easy.

Control circuits are easier to wire... easier to operate... with new Westinghouse Type SD Push Buttons. Their rounded, compact design saves space... their clearly numbered terminals make wiring simple. Symmetrical design allows mounting with either end up. Once installed, the generous-sized buttons, shrouded to prevent accidental operation, insure handy, convenient and dependable performance.

Type SD push buttons are available in single, double and multiple circuit stations, in special mountings and as units for built-in applications. Write for the new bulletin describing them — ask for bulletin 15-020

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Dept. 7-N.

J-20882

Westinghouse

Type SD Push Buttons



EQUIPMENT *News*

Lighting Equipment

A new type of complete, self-contained fluorescent luminaire uses two 40-watt fluorescent lamps. Fixture prevents collection of dust and simplifies maintenance. It is designed for industrial, commercial, school and public building installations. Exterior finish is aluminum. Fixtures are supplied completely wired, less lamps, with two loops for hanging and 8 ft. extension cord. The Wiremold Company, Hartford, Conn.



WIREMOLD LUMINAIRE

Magnetic Switch

A magnetic switch for control of air-conditioning equipment motors directly from contacts of room thermostat or other low-voltage control instrument. Unit consists of a three-pole magnetic switch mechanism, overload relays, and low-voltage control transformer. Switch and transformer combination protects motor against overload. Normally open interlock is furnished to provide correct sequencing with other equipment when desired. General Electric Co., Schenectady, N. Y.



G-E MAGNETIC SWITCH



BURNDY TYPE TNT CONNECTOR

Connector

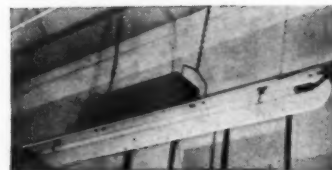
A complete line of electrical connectors and bus supports for square tubular bus, both ventilated and unventilated types. Clamping pressure is exerted on corners of tube and buckling of tube walls is prevented. Drawings are available for connectors to join cable, round tubing, flat bar or other conductor forms to square tubing. Burndy Engineering Co., Inc., 459 East 133d Street, New York, N. Y.



IDEAL BX ARMOR CUTTER

BX Armor Cutter

This BX armor cutter is handy pocket size and easy to use. Jaws are formed to take BX cable of any make, two or three wire No. 12 or No. 14. To use cutter, open jaws wide, insert BX and snip. No adjustments are necessary. Cuts anywhere along length of cable for opening into outlets, switch boxes, etc. Steel cutting blade is removable for sharpening. Ideal Commutator Dresser Co., 1041 Park Avenue, Sycamore, Ill.



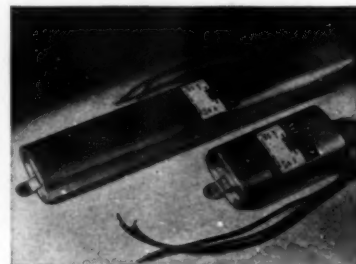
WESTINGHOUSE FLUORESCENT LAMP

Fluorescent Lamp

A new 85-watt 58-inch type RF fluorescent lamp producing white light, is designed for industrial service. May be operated on either 105-125-volt or 210-225-volt 60 cycle a.c. circuits in special equipment which provides d.c. through use of rectifying device. New white and blue-white lamps are interchangeable in single and twin fixture units. Light output is rated at 4,250 lumens. Westinghouse Lamp Division, Bloomfield, N. J.

Capacitors

These capacitors are designed for fluorescent lamp power-factor correction. They may be included in fixtures as initial built-in equipment or added later. Capacitors are of oil-filled paper type. Flat metal can is hermetically sealed. Insulated wire terminals at one end. Three types available. Mounting feet permit flat mounting. Aerovox Corporation, New Bedford, Mass.



AEROVOX CAPACITORS

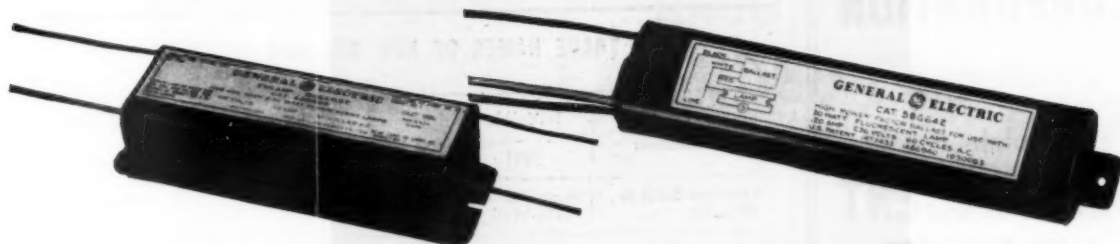
Lighting Fixture

The Grenadier is a two lamp fluorescent unit, designed for low ceiling areas. It requires 4 1/2-in. of space for mounting. It uses two-lamp ballast with separately mounted starters in lamp holders. Switch can be renewed if it is damaged or wears out. Ballast has power-factor correction; stroboscopic effect minimized; better voltage regulation; quieter operation and overall power factor of above 95 per cent. Can also be supplied with semi-rigid hanger for lower mounting height. The F. W. Wakefield Brass Co., Vermilion, Ohio.



WAKEFIELD LIGHTING FIXTURE

For RELIABLE, LOW-COST High-power-factor Fluorescent Installations



Specify G-E Tulamp High-power-factor Ballasts

FOR a very small increase in over-all fixture costs, all the important advantages of *high power-factor* are now available for fluorescent-lamp installations. Fixtures equipped with G-E single-lamp, high-power-factor ballasts or Tulamp ballasts, operate at power-factors of 90 per cent or above, and give you:

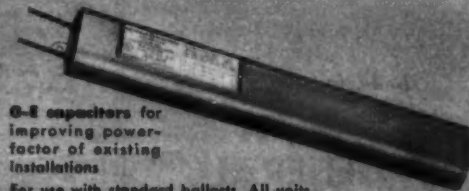
1. Greater capacity of wiring by reducing the current required by each lamp.
2. Lower losses and better voltage regulation in feeders and branch circuits.
3. Full compliance with all power-factor regulations of public utilities and regulatory bodies.

NEW Single-lamp High-power-factor Ballasts

In addition, there is built into every General Electric ballast reliability and long life. All units are listed by the Underwriters' Laboratories—all Tulamp units are certified by the Electrical Testing Laboratory.

It will pay you to demand G-E ballasts in the fluorescent lighting fixtures you buy. Their high quality assures long, satisfactory service and easier selling—customers know the value of the G-E monogram. For full details on G-E ballasts, call your G-E Office or write for Bulletin GEA-3293. General Electric, Schenectady, N. Y.

How little high power-factor costs		
Nominal line voltage	Lamp watts	Estimated increase in fixture costs using Tulamp ballasts
115	15	20%
115	20	20%
115	30	3%
115	40	2%



G-E capacitors for improving power-factor of existing installations

For use with standard ballasts. All units are Pyranol-filled to assure stable characteristics and long life

GENERAL ELECTRIC

403-6

Now GENERAL TRANSFORMER CORPORATION

presents

a complete line of FLUORESCENT LAMP AUXILIARY EQUIPMENT

based on over a year's
experience building more
than

200,000

auxiliaries and ballasts for
America's leading fluores-
cent lamp manufacturers
... and 12 years' experi-
ence manufacturing quality
electrical parts.

•
**OUR PRICES ARE RIGHT
OUR MERCHANDISE
IS GUARANTEED**

•
*Send for Quotations
and Information*

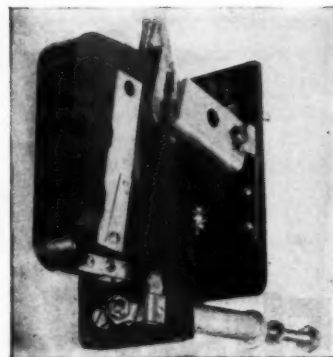
GENERAL TRANSFORMER CORPORATION

1254 West Van Buren Street
Chicago, Illinois

EQUIPMENT *News*

Industrial Contactors

A new line of improved heavy-duty d.c. magnetic contactors is known as "Series 200" Type SM. Some of the improvements are—armature over-travel increased; contact tips larger; nitrided bearings; heat is conducted away from contact surface by enlarged mass of copper; bearing pin poles of armature bracket are reamed; blowout coil is brazed to contact support and heating is reduced. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

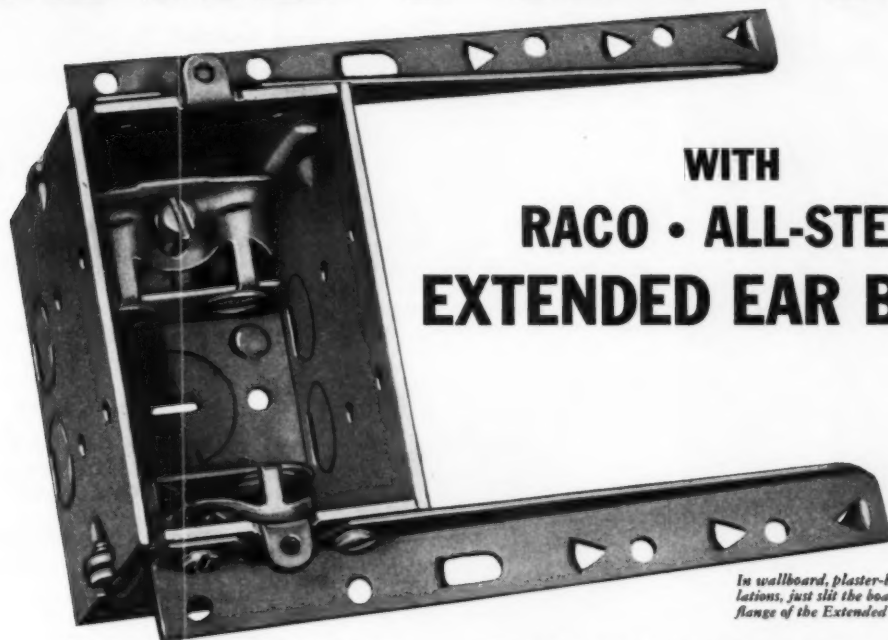


WESTINGHOUSE INDUSTRIAL CONTACTORS

TRADE NAMES OF NEW BUILDING WIRES

Name of Manufacturer	Trade Name of Manufacturer's Small Diameter Building Wire			
	RHT	RPT	RU	SN
American Steel & Wire Co.	Amperox Thin-Wall	Amerite Thin-Wall	.....	Ampyrol
Anaconda Wire & Cable Co.	Anaconda	Anaconda	.....	Anaconda Densheath
The M. B. Austin Co.	Austin RHT	Austin RPT	Austin RU	Austin SN
Circle Wire & Cable Corp.	Circle RHT	Circle RPT	.....	.....
Collyer Insulated Wire Co.	Collyer's RHT	Collyer's RPT	Collyer's RU	Collyer's SN
Crescent Insulated Wire & Cable Co.	Crescent Endurite	Crescent	.....	Crescent Synthol
General Cable Corp.	Guardian Thermax Small Diameter Braided	Guardian Performance Small Diameter Braided	.....	Guardian Gen-caseal Small Diameter
General Electric Co.	.....	.....	.....	Flamenol
Hazard Insulated Wire Works Division of The Okonite Co.	Permite Small Diameter	.....	.....	Hazakrome Synthetic Small Diameter
National Electric Products Corp.	National Dilec RHT	National Dilec RPT	National Dilec RU	National SN
Rockbestos Products Corp.	.....	.....	.....	EX
John A. Roebling Sons Co.	Roebling Safe-cote Heat Resistant Thin-wall	Roebling Safe-cote Performance Thin-wall	Roebling Safe-cote Latex Thinwall	Roebling Synthetic Thin-wall SN
	Roebling Dilec Heat Resistant Thinwall RHT	Roebling Dilec Performance Thinwall RPT	Roebling Dilec Latex Thinwall RU	
Simplex Wire & Cable Co.	Simplex Super-aging	.....	Latex	Plastex
Triangle Conduit & Cable Co., Inc.	Triangle RHT	Triangle RPT	.....	Triplastic
U. S. Rubber Company	U. S. Eonite	U. S. Relio	U. S. Laytex Dilec	U. S. Synrub

MORE PROFITS



WITH RACO • ALL-STEEL EXTENDED EAR BOXES

The MCX box, illustrated above, may be had with or without lath supports.

THE Extended Ear type of mounting bracket has, for years, won well-deserved popularity in many sections of the country. Made of galvanized steel angles, these improved Extended Ears are longer and stronger. They are designed to bear a heavy strain without bending or breaking.

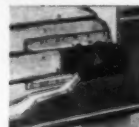
In all RACO • ALL-STEEL Extended Ears there are 4 nail holes and 4 gauging points, which can also be used for nailing. These points, when lined up with the edge of the studding, set the box parallel with the studding and are spaced the right distance to allow for standard trim. The ears are fastened securely to the body of the box by binder-head screws. The ears are slotted for close adjustment with the plaster line.

Variation of the Extended Ear principle for receptacles. The Extended Ears are mounted on the sides of the box instead of the ends.



MCR

Ears properly spaced from the top of the box, for horizontal mounting of receptacles in wooden baseboard.



MCW

Distributed nationally by:

ALL-STEEL-EQUIP COMPANY

INCORPORATED

606 Griffith Avenue, Aurora, Illinois

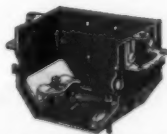
Factories: South Bend, Ind.; Aurora, Ill.



RACO • ALL-STEEL "SIDE-MOUNT" SWITCH BOX. Mounts to side of studding, affording a neater wall-board job. Bracket is detachable.



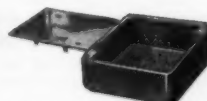
RACO • ALL-STEEL CABLE BOX—3½" or 4" octagon. Permits side or back entrance of all sizes of non-metallic cables.



RACO • ALL-STEEL BEVELED CORNER SWITCH BOX with BN Clamp for all types of non-metallic cables.



RACO • ALL-STEEL METALLIC CABLE BOX—3½" or 4" octagon with non-protruding clamp screws. Box may be installed on flat surface.



RACO • ALL-STEEL 4" SQUARE BOX with mounting bracket. Simplifies the installation of switches and receptacles.



RACO • ALL-STEEL • PRODUCTS

Switch Boxes • Outlet Boxes • Cutout Boxes • Cabinets • Conduit Fittings
Distributors in All Important Centers





The uniform high quality of G-E Building Wire makes installation easy and helps to assure long dependable service. The best raw materials are used. Manufacturing is carefully done.

All grades of G-E Building Wire are easy stripping, clean stripping and easy pulling. All grades have uniformly small diameters. Every wire carries the grade of insulation, type, voltage and size printed right on the braid. Different colored braids are available.

For more information see the nearest G-E Merchandise Distributor or write to Section W-0126, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC



[FROM PAGE 78]

Starter

New improvements have been developed in Bulletin 9586 across-the-line starter for the control and protection of polyphase squirrel cage motors up to 5 hp. Some of the features are hook-on cover which can be removed for easy installation; loosening one screw permits removal of operating mechanism for easy wiring and conduit work; contacts are made of heavier silver; overload relay is smaller in size. Available in following types of cover control; reset only for 2 or 3 wire remote control; start and stop reset buttons for 3 wire control; three position selector switch for manual-off-automatic local control or 2 or 3 wire remote control. Starter can be obtained in open panel type for cavity or built-in mounting. Cutler-Hammer, Inc., Milwaukee, Wis.



CUTLER-HAMMER STARTER

Utility Light

A new unit for use with 150-watt incandescent projector flood and spot lamps for garages, service stations, factories, warehouses, display rooms, studios. Lamp holder and bracket, mounted on base with detachable, ball-bearing swivel casters. Slot provided in base to hang on wall. Equipped with 20-foot, flexible hard service cord and rubber plug. Maximum height 13-inches, diameter of base 10-inches. Wire guard protects lamp. Steber Manufacturing Co., 1020 West Adams St., Chicago, Ill.



STEBER MOBILE UTILITY LIGHT

MINERALLAC HANGER



Conduit $\frac{3}{8}$ "— $2\frac{1}{2}$ "
Cable to $2\frac{1}{8}$ " (with Bushings)

Cadmium and Everdur
MINERALLAC JIFFY CLIP



Sizes from .250" O.D. Tubing
to $1\frac{1}{4}$ " conduit.

See your Jobber

New York City Office
Theodore B. Dally
50 Church Street

MINERALLAC ELECTRIC CO.
25 N. Peoria St., CHICAGO

*easily—
swiftly—*

"for KEEPS"!

That's the way you can make all
your electrical connections... with



SOLDERLESS LUGS

Look for the V-Bottom wire opening—a "first" for ILSCO—the source of "for keeps" grip.

• Look to your Electrical Wholesaler for your electrical needs.

DEPT. 5 EC

IlSCO Copper Tube & Products, Inc.
5629 Madison Road, Cincinnati, Ohio



Carl Gebbers, President, Ajax Electric Company, Tacoma,

Tells and Proves that

Teletalk *Amplified*
Intercommunication

is profitable to the contractor

USES
TELETALK...

DISPLAYS
TELETALK...

6380 FT. INSIDE TWIST #12 TELEPHONE
WIRE TO THE 70-5A-45 TELETALK
SPEAKERS AND PUSH BUTTONS

6 - EDWARDS #30D CONNECTING BLOCKS
1 LOCATED ON EACH FLOOR

SELLS AND INSTALLS
TELETALK...

MICROPHONE

60' AMPLIFIER

#272 AM
SPECIAL
TELETALK

#6-20 PAIC #22 BS.
FIRE PROOF BRAID
CABLE TO CONNECTING
BLOCKS - TOTAL 500'

AND INCLUDES
WEBSTER ELECTRIC
AMPLIFYING EQUIPMENT

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WEBSTER ELECTRIC COMPANY, Racine, Wisconsin, U. S. A.
Established 1909. Export Department: 100 Varick St., New York City
Cable Address: "ARLAB", New York City

AJAX ELECTRIC COMPANY
ELECTRICAL CONTRACTORS
TELEPHONE EDWY 2341

7675 Broadway
Tacoma, Washington March 20, 1940

Rebtor Electric Company
Racine, Wisconsin

Gentlemen:

We have sold and installed several Teletalk systems in Tacoma and neighboring cities. We find our customers more than satisfied with this equipment. The Teletalk system has become an important part of our installation work.

The installation we completed about a year ago in the Lutheran Old Peoples Home at Puyallup was an interesting piece of sales effort and a very successful piece of installation.

It was sold to a donor who wished to make a gift to the home which could be both permanent and useful. Needless to say, there were many things which appeared much but a gift is a gift and it was our job to convince the people at the home of the extreme usefulness of the gift as applied to their problems.

I think it is a tribute to the efficiency and simplicity of this Teletalk installation that the superintendent and staff, to the last man, now after a year's use, regard the device as the most convenient thing they own.

In relieving the pressure on the staff, they estimate that it has increased their effectiveness about one person. Thus the entire one year's operation pays the cost of the installation.

We recently placed a Teletalk system in the offices of the John Harlick Theaters in Tacoma and everyone is very pleased with it. It permits instant contact with box offices, managers offices, accounting and secretarial departments besides permitting the management to pick up audience reaction from a concealed bag in the lobby.

The installation of these systems is not difficult to do. The results are very gratifying to us.

Yours very truly,

Carl Gebbers
President/Manager

AND HERE'S
ANOTHER
INSTALLATION

Electrical Contractors who are not on the Webster Electric Teletalk "band wagon" are just simply passing up a big opportunity to sell a good product at a fine profit; to sell wire, conduit, junction boxes and other supplies, plus the highly profitable item of labor... Mr. Gebbers' story as set forth in this page is only typical of many others.

Webster Electric

"Where Quality is a Responsibility and Fair Dealing an Obligation"

MANUFACTURERS OF TELETALK INTERCOMMUNICATION AND PAGING SYSTEMS • POWER AMPLIFIERS AND SOUND DISTRIBUTION EQUIPMENT • RADIO PHONOGRAPH PICKUPS • IGNITION TRANSFORMERS AND FUEL UNITS FOR OIL BURNERS

180 AMPERE Heavy-Duty, Solenoid-Type TIME SWITCH



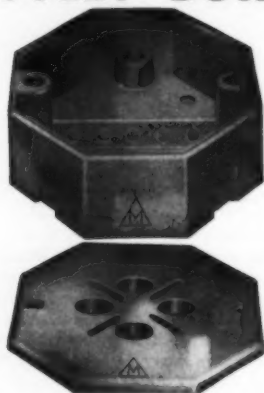
For those heavy loads to be automatically time controlled each day, the Model 1290 AUTOMATIC Time Switch has two knife-blade poles with a capacity of 90 amperes each; 180 amperes on a split load!

A companion model is the Number 1250 with a capacity of 50 amperes on each of its two poles, or 100 amperes on a split load.

Write For Information and
Discounts

**Automatic
Electric Manufacturing Co.**
MANKATO, MINN.

Profit by USING ILLINOIS Dependable Porcelain OUTLET BOXES



*Glazed and engined styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

Contractors who use these products not only establish themselves most sagaciously with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

EQUIPMENT *News*

[FROM PAGE 80]

Lighting Unit

A new two-tube "RF" fluorescent lighting unit designed for industrial areas. Fixture consists of self-contained auxiliary mounted on porcelain enamel reflector. Rated at 200 watts and operates two 85-watt RF tubes, each 58-in. long. Available in original blue-white tube and a new white lamp. General Electric Lamp Department, Nela Park, Cleveland, Ohio.



G-E LIGHTING UNIT

Lamp Receptacle

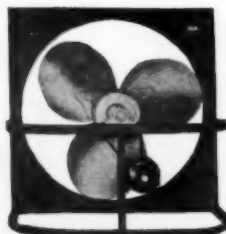
A new receptacle for prefocused lamps. Some of the features are base ventilation; high heat resisting molded asbestos-base body; precision production and assembly procedure; positive "stop"; low contact resistance. It is rated at 1000-watts, 125- to 250-volts. A cap is also made to fit, as well as ceramic receptacle with the same features for applications where heat-factor is high. American Phenolic Corp., 1250 Van Buren St., Chicago, Ill.

AMERICAN
PHENOLIC
RECEPTACLE



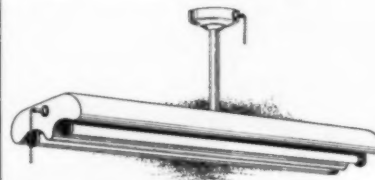
Attic Cooler

These attic coolers are constructed to mount in pent-house, on floor or on window. Some of the features are—welded steel frames; quiet blades; motors equipped with G.E. "Thermo-tectors"; smooth operation; simple installation; rubber mounted motors and housings. Complete with pillow blocks, pulleys and V-belt drive. For a.c. 110/120-volts, 60 cycles. Circulators & Devices Manufacturing Corp., 100 Prince St., New York, N. Y.



FRIGID AIR CIRCULATORS

Levolier the Dependable Switch for FLUORESCENT Lighting Control



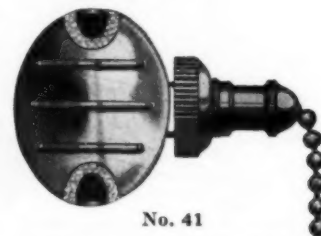
Designed to control either 110-volt or 200-volt installations, and to operate from the fixture pan or canopy, Levolver Switches give you maximum efficiency on Fluorescent Units. Small and compact, these Levolver Switches carry the load without pitting, arcing or heating, making for long, dependable service.



No. 276

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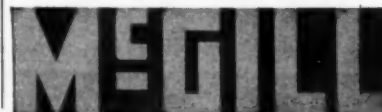
No. 41—S.P., 6 Amp., 125 V.—3 Amp., 250
No. 1010—S.P., 10 Amp., 125 V.—5 Amp., 250
No. 276—D.P., 6 Amp., 125 V.—3 Amp., 250
*No. 1020—
Two-Circuit 10 Amp., 125 V.—5 Amp., 250
*Control: 2—3—All—Off.



No. 41

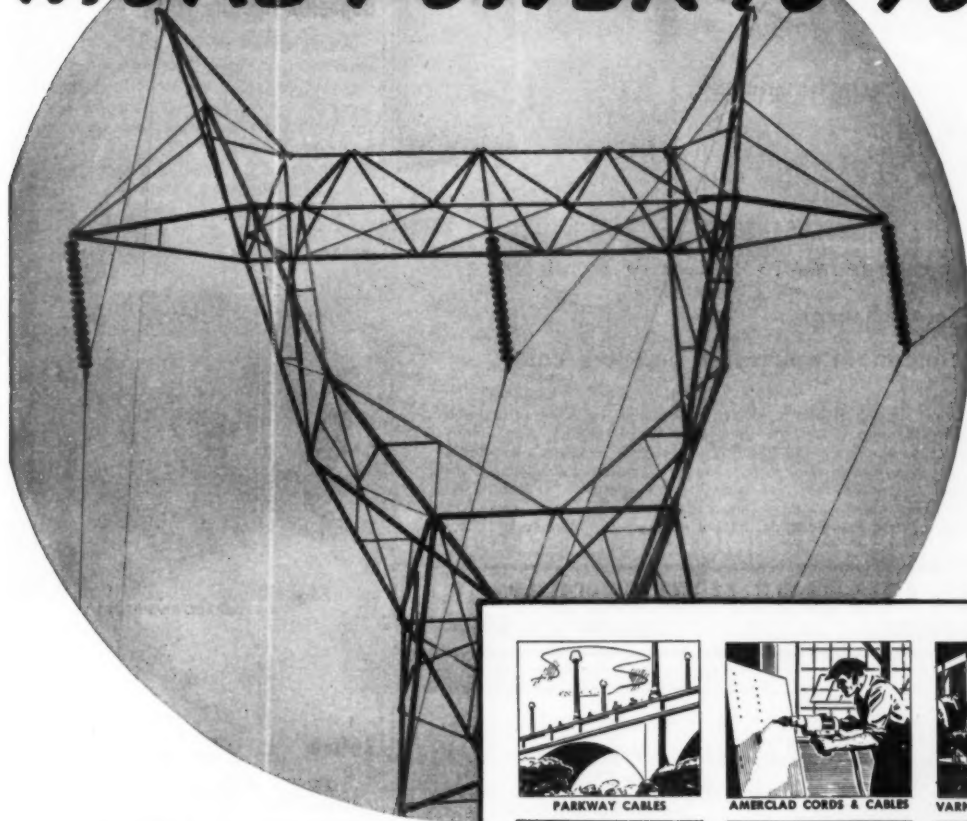
See your Electrical Wholesaler for detailed information or write direct to—

McGILL MANUFACTURING CO.
Electrical Division
Box No. 670
VALPARAISO, INDIANA



Electrical Contracting, June 1940

MORE POWER TO YOU!



TRACE the developments made in the electrical wire and cable field and you trace the history of the American Steel & Wire Company. For more than a century we have been developing new products, as well as improving and modernizing the old. During more than 100 years of wire making we have encountered innumerable problems in a field notable for progress and invention. In that period we have built up a background of experience that is always at your service.



PARKWAY CABLES



AMERCLAD CORDS & CABLES



VARNISHED CAMBRIC CABLES



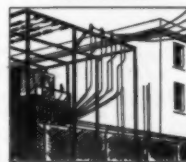
BUILDING WIRES



RELIANCE WEATHERPROOF WIRES



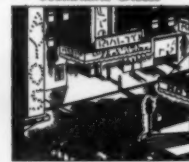
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UNITED STATES STEEL

Badger

Synchronous
ELECTRIC TIME
SWITCHES



CONTRACTORS LIKE THEM BECAUSE:

they are dependable and easy to install

USERS LIKE THEM BECAUSE:

of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

RELIANCE AUTOMATIC LIGHTING COMPANY
1937 MEAD STREET
RACINE, WISCONSIN

EQUIPMENT *News*

[FROM PAGE 82]

Capacitor-Motors

An extension of this line of capacitor-motors for refrigeration and air-conditioning service. Ratings have been extended from $\frac{1}{2}$ to $\frac{3}{4}$ hp. to 3 hp. inclusive. It is a single-phase motor that obtains starting and pull-up torques by use of two stator windings and a capacitor. Requires oiling only at infrequent intervals; does not interfere with radio reception and requires little maintenance. General Electric Co., Schenectady, N. Y.



G-E CAPACITOR-MOTOR



Your first trial with CLIPPER supports will convince you that it is the best, easiest and quickest way to obtain the desired results.



CLIPPER MANUFACTURING CO.
42 E. Strand, Kingston, N. Y.

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Address.....
City.....
State.....
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The Little Man
Who's Always There
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TRADE
RATTAN
MARK
MAN

The MARR
A Perfect Joint Connector
(MADE OF BAKELITE)



Approved by Underwriters

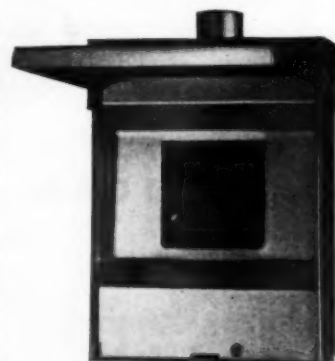
THE RATTAN MANUFACTURING COMPANY

522 STATE STREET
NEW HAVEN, CONN., U. S. A.

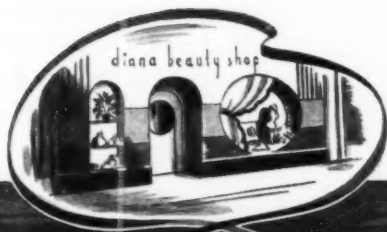
GENERAL SALES AGENTS HATHEWAY AND CO.
220 CHURCH STREET, NEW YORK, N. Y., U. S. A.

Switch

Design changes have been made in Catalog No. 39902, outdoor 60-ampere switch. It is for 3-wire S/N 115-230 volts a.c. service, with a grounded neutral. These switches are used as main service disconnects or as range switches on outdoor installations wherever protection from the weather is necessary. A "hold up" feature on cover allows it to be held in open position while wiring or inspecting; provision for sealing or padlocking cover; metal trim makes it dead front so no live parts are exposed. Can be furnished with or without conduit hubs and nipples. Square D Company, Detroit, Michigan.



SQUARE D SWITCH



*for Smart Beauty Shops
... and SPRAWLING INDUSTRIAL PLANTS*



There Is an Automatic Electric PRIVATE TELEPHONE SYSTEM for *EVERY* Purpose

Because the need for fast interior communication is recognized in business organizations of every size—from tiny shops to huge factories—your market for Automatic Electric private telephone systems is practically unlimited.

In answer to the varied demands of this broad market, Automatic Electric offers a line of private systems ranging from the simplest 2-station sets up to the most elaborate systems employing hundreds of stations.

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Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 West Van Buren Street, Chicago, Illinois
Sales and Service Offices in Principal Cities

In Canada: Canadian Telephones & Supplies, Limited, Toronto

Electrical Contracting, June 1940

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CONDUIT PRODUCTS



UNIFORM HIGH QUALITY

G-E Conduit Products will give dependable service indefinitely. They are easy to install. The line includes G-E White Rigid Conduit, G-E Flexible Conduit, G-E Electrical Metallic Tubing, G-E BX Armored Cable, G-E BraidX, G-E Service Entrance Cable, G-E Boxes and Fittings.

For further information see the nearest G-E Merchandise Distributor or write to Section C-0126, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

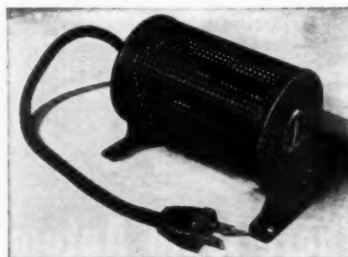
GENERAL ELECTRIC

EQUIPMENT News

[FROM PAGE 84]

Resistor

A line of general-utility voltage-dropping resistors. Series HT units are available in any resistance and wattage rating from 100 watts up. Can be used for any voltage-dropping or current regulating purpose, such as operation of 110-volt equipment on 220-volt supply, operation of soldering irons and electric motors. It is housed in a 3-inch diameter perforated metal shell 4½-inches long, with mounting feet, for the 100-watt size. Clarostat Mfg. Co., Inc., 285 N. Sixth St., Brooklyn, N. Y.



CLAROSTAT RESISTOR

Lamp Controls

A new series of controls or auxiliaries for use with all sizes of fluorescent lamps has been developed. It includes complete series of controls with power factor of 90% or more for both single lamp operation and two lamp split-phase operation. Also includes low power factor units for use where conditions require it. Two-lamp controls fit within the No. 3000 Wiremold fluorescent lighting channel. Two-lamp controls have high power factor, reduced stroboscopic effect and built-in compensator. The Wiremold Company, Hartford, Conn.



WIREMOLD CONTROLS

Extruded Tubing

A new extruded tubing developed for electrical insulation. This tubing is claimed to have outstanding mechanical strength; improved tear and abrasion resistance; greater solvent resistance; increased heat resistance; continuous lengths; flexibility; inside and outside smoothness; small wall thickness; withstands soldering temperatures and other heat without flow. Produced in five standard colors from size No. 20 to 1½-in. Suitable for use in automotive, aviation, communications, electrical, instrument, marine, radio and other fields where flexible tubing is used in wire insulation against heat, moisture, oils, etc. Irvington Varnish & Insulator Co., 24 Argyle Terrace, Irvington, N. Y.

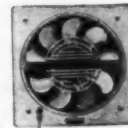
At Last - - A Low-Cost Ventilator for the Small Home Market!

• Cash-in on the current building boom with the new 8-inch Ventrola. It's designed specially to be built into houses in the popular low-price group. The New Model 40 has all the outstanding features and the same mechanical quality and efficiency as the well-known, larger Ventrola models. Yet it is priced well within the budget of the average small-home builder. Its ultra-modern design adds beauty to any room.

1. Ventrola installation is easy. Adjustable sleeve adapts to any type of wall construction or thickness.



2. The Ventrola Fan-chase is backed with valuable sales promotion material. Its "Good Housekeeping" Seal of Approval further guarantees customer enthusiasm and satisfaction.



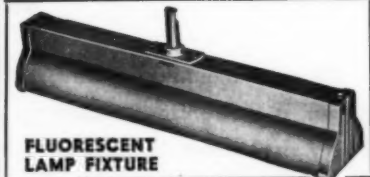
3. The new 8-inch Model 40 rounds out the Ventrola line of outstanding ventilator values. Model 40-5" (400 C. F. M.), \$19.75. Model 60-10" (650 C. F. M.), \$29.00. Model 50-10" (500 C. F. M.), \$25.00.

Get the money-making facts now! Write today for literature, prices, discounts.

McLAUGHLIN VENTILATOR CO.
253 East 9 Mile Road, Ferndale (Detroit)



KEEPS AIR FRESHER AND ODOR-FREE



FLUORESCENT LAMP FIXTURE

MULTI REFLECTORS

build good lighting business . . . You're ready for any installation job with MULTI Reflectors.

We can supply any type for modern, efficient lighting of factories, shops, offices, or outdoor needs. Contractors give MULTI Reflectors hearty approval because they are simple to install—they give no trouble—they help them to get more jobs. Enthusiastic endorsement from users mean more installations—more installations mean more money. Install MULTI Reflectors for good business.

MULTI ELECTRICAL MANUFACTURING CO.
1840 W. 14th St. Chicago, Ill.



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PANTHER & DRAGON TAPES

1. First to be Wrapped and SEALED in Cellophane
2. Perfect Adhesiveness and Tensile Strength.
3. Strong Distinctive Green Core.
4. Colorful Attractive Boxes.
5. A Company in the Insulation Business Since 1878.



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GLARELESS FLUORESCENT Illumination by EFCOLITE

EFCOLITE now offers a new series of moderately priced shielded Fluorescent Lighting Fixtures, designed to yield maximum effective glareless illumination for stores, offices and public buildings, where "easy-seeing" is essential.

The New Efcolite Fluorescent Line includes a wide range of modern designs for every lighting need—scientifically engineered to yield maximum lighting efficiency.

An attractively styled shielded Fluorescent Unit, available for 2, 3 or 4 bulbs, in 20 watt and 40 watt sizes.

EFCOLITE
Fluorescent
CATALOG "L-60"
WILL GIVE YOU
MANY SALES
IDEAS

EFCOLITE CORPORATION

TRENTON, N. J.

How to wire for light and power...

Step-by-step methods fully and simply explained in this new book

Just Out H. P. Richter's

PRACTICAL ELECTRICAL WIRING

Residential, Farm, and Industrial

500 pages, 5½ x 8
illustrated
\$3.00

Covers:

I. Underwriters and codes; electrical principles and measurements; basic devices and circuits; wire, sizes and selection; connections and joints; residential and farm motors; etc.

II. Planning an installation; specific outlets; switches and other devices; old work; farm wiring; isolated lighting plants; wiring apartment houses; etc.

III. Planning non-residential installations; non-residential lighting; miscellaneous problems; wiring for motors; wiring schools, offices, stores, churches; etc.

HERE is a complete course of instruction for those who want to learn how to do electrical wiring. Begins with very first elements and takes the reader by easy steps, plain instructions and methods, to the completion of typical wiring jobs in accordance with official requirements. Employs simple language; confines mathematics and theory to the minimum necessary for understanding of the work; covers medium voltage jobs of the types that are most in demand.

10 DAYS' EXAMINATION—SEND THIS COUPON

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.

Send me Richter's Practical Electrical Wiring for 10 days' examination on approval. In 10 days I will send \$3.00, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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Company F-E-C-6-40

(Books sent on approval in U. S. and Canada only.)

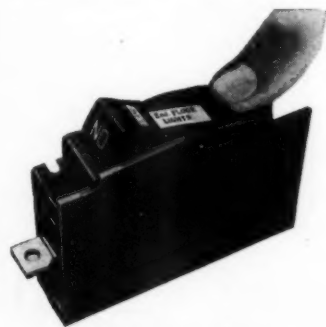


EQUIPMENT *News*

[FROM PAGE 84]

Circuit Breaker

Circuit Master is a combination switch and automatic circuit breaker for snap-action, on and off manual switching and automatic opening on overloads or short circuits. Red signal indicator projects through handle whenever circuit is automatically opened by overload or short circuit. It cannot be held closed to prevent automatic opening. Ratings are 15 to 50 amp., 120-volt a.c.—120-240-volt a.c. Bull Dog Electric Products Co., Detroit, Mich.



BULL DOG CIRCUIT MASTER

Feed Oiler

A new, visible, unbreakable wick feed oiler for use on machinery which operates intermittently. Lever at top, when in vertical position, starts feed and when "flipped" to side shuts off feed. No flooding and waste of oil when machine is idle. Oil supply is always visible. When oiler is filled above point where wick enters center tube, surplus oil drains into bearings, flushing it thoroughly. When oil recedes to opening in tube, wick automatically feeds oil to bearing by capillary action. Dust-proof, self-closing filler cap has an extended lip on cover. Available in one, two and four ounce capacities. Trico Fuse Mfg. Co., 2948 No. 5th St., Milwaukee, Wis.



TRICO FEED OILER

LEVITON

METAL SHELL WEATHERPROOF SOCKETS

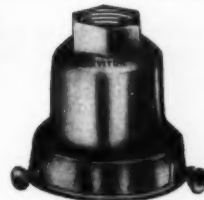
A diecast shell guaranteed for all weather conditions in either a straight or 90° angle, 1/2 inch pipe threading with set screw. The interior porcelain is glazed all over and is held down with two 6/32 screws against a gasket which makes it positively watertight. Made in medium base with 2 1/4 inch shade holder only.



CAT. NO. 8314



INTERIOR VIEW



CAT. NO. 8306



CAT. NO. 691

PULL CHAIN CANOPY SWITCHES

Rated 3A-250V, 6A-125V T
(T rated for Type C loads)

These switches are made in Single Pole, two circuit and two speed types and are adapted to fit low canopies. The body of the switch is only 1 3/16 inches in diameter by 1 inch overall height, and contains a very fine accurate snap action mechanism. Can be used on Fluorescent Fixtures or appliances requiring this high rating.

WRITE FOR CATALOG

LEVITON

KWIKCHANGE LINE

COMPLETE WITH EVERY TYPE OF DEVICE

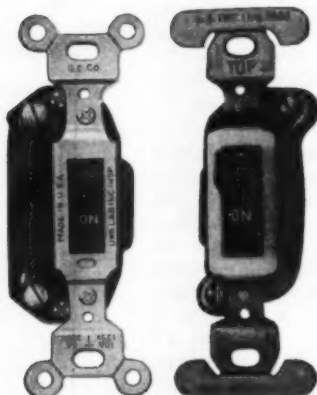
DESIGNED TO MEET ALL MODERN NEEDS

ASK FOR COMPLETE KWIKCHANGE CATALOGUE

LEVITON MANUFACTURING CO.
236 GREENPOINT AVE., BROOKLYN, N. Y.

111 N. Canal St., Chicago, Ill. 420 S. San Pedro St., Los Angeles, Calif.

LOOK



G.E. OFFERS TWO LINES OF MODERN SWITCHES

Here are switches that will fill your everyday needs—designed for easy installation and long service. One line is composed of standard switches completely insulated with Textolite; the other is composed of silent, mercury Sphinx Switches. Single-pole, double-pole, 3-way and 4-way types are available in both lines with either brown or ivory handles.



"GET THEM IN PACKAGES"

These switches are available in sales-provoking packages of 50 G-E Standard Switches, 15 G-E Sphinx Switches and an action display to help you demonstrate and sell. Sales promotion material is also available.

For more information about these modern switches or about the switch package see the nearest G-E Merchandise Distributor or send in the following coupon.

MAIL THE COUPON



General Electric Company, Section D-0126
Appliance and Merchandise Department
Bridgeport, Conn.
Sir: Please send me detailed information about G-E Sphinx Mercury Switches, G-E Standard Switches and the G-E Switch Package.

Name _____
Address _____
City _____ State _____

GENERAL ELECTRIC

EQUIPMENT *News*

[FROM PAGE 88]

Lighting Fixture

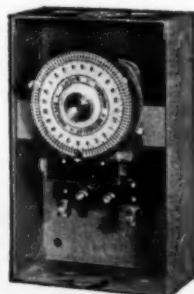
A lighting fixture using three or four 18- or 24-inch fluorescent tubes, for use in homes, offices and sales rooms. Overall fixture lengths are 39-inches for 15-watt tubes and 45-inches for 20-watt tubes. Also available with link chains for horizontal suspension from low ceilings. Auxiliary reactors, power factor correctors and starting switch are self contained. Seven colors are available. Mozart Specialty Corp., 7 North Racine Ave., Chicago, Ill.

MOZART
FLUORESCENT
FIXTURE



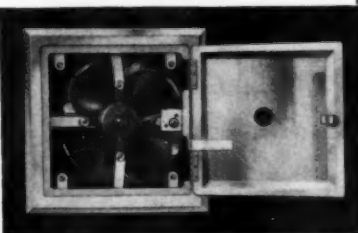
Tork Clock

A Little Giant, self-starting, synchronous Tork clock. Single pole, 35 ampere, for not over 3800 watts. Timed and powered by slow speed "P" type motor in which coil, field and rotor are sealed in steel housing. All parts revolving faster than 8 r.p.m. run in oil. Switch terminals are of solderless lug type. Clock motor and switch terminals are separate for wide range of circuit voltages. Dial may be set to one minute accuracy by low geared ratchet center knob. The Tork Clock Co., Inc., Mount Vernon, N. Y.



TORK LITTLE GIANT CLOCK

NEW LOW PRICE \$21.50 List



Signal announces a reduced price on the V-50 Wall Box Kitchen Vent Fan. A bigger value than ever. See your jobber today.

10" STREAMLINE OSCILLATOR \$9.95 List

This No. 562 Induction (4 Pole) A.C. Oscillating fan is unusually quiet and moves 610 C.F.M. Has one speed switch. Finish is green. Ask your jobber about it.



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Offices in all principal cities

SIGNAL

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WANTED**

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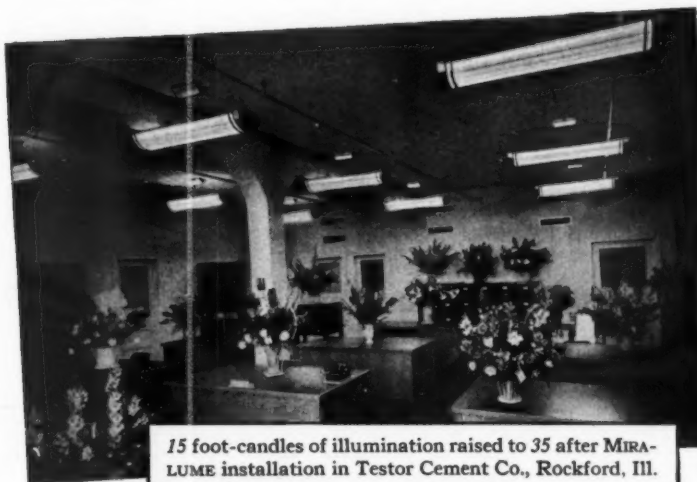
Containing complete information
on electrical and allied products

Use your copy regularly
to save time and money!

ELECTRICAL CONTRACTING
330 West 42nd Street, New York

AMAZING HYGRADE MIRALUMES* MAKE FLUORESCENT BIG NEWS!

Sensational indoor **DAYLIGHT** High lighting intensities of **cool** daylight practical and ready now!



15 foot-candles of illumination raised to 35 after MIRALUME installation in Testor Cement Co., Rockford, Ill.

***MIRALUMES are complete fixtures or Hygrade Fluorescent Light—supplied wired and ready to install or unwired. They provide—(1) several times the light; (2) light without harsh glare or shadows; (3) COOL light—75% less radiant heat for equal light intensity!**

NOTE—Extraordinary lighting efficiencies are obtained in fluorescent lamps by tuning the electric discharge to concentrate its ultra-violet energy at the precise 2537 Angstrom Unit wavelength most effective in causing the porous film (Hygrade Patent 2,096,693) to generate light. This achievement, so important to the efficiency of HYGRADE MIRALUMES, is described in Patent No. 2,126,787, now controlled in this field by HYGRADE.

Cash in on the tremendous hot-weather demand for these nationally-advertised "packages" of cool daylight—Fluorescent at its finest!

THIS Summer, as never before, Electrical Contractors can look forward to big profits in every commercial and industrial field—with HYGRADE MIRALUMES!

For Hygrade Fluorescent Light literally sells itself—in stores, offices, factories, hotels, restaurants, theatres—*everywhere!* Overnight, lighting is *modernized*—interiors *beautified*—efficiency *increased*—eye-strain, accidents and fatigue *decreased!*

You can *depend* on Hygrade Fluorescent Light—build business on it—because MIRALUMES are *complete* units—designed, engineered, built and *guaranteed* by HYGRADE!

MIRALUMES are priced right to you, and they're eligible for F.H.A. financing!

SHOWN BELOW are two of many MIRALUMES ready now! Every MIRALUME is corrected for power factor and stroboscopic effect (flicker), and starters are easily accessible.



FOR COMMERCIAL USE—MIRALUME HF-201; 200-watt unit; 4 40-watt tubes; approximate length, 50".



INDUSTRIAL MIRALUME F-100; 100 watts; 2 40-watt tubes; approximate length, 54".

Fluorescent at its Finest—
Hygrade Miralumes

Hygrade Sylvania Corp., Est. 1901. Makers of Hygrade Incandescent Lamps and Sylvania Radio Tubes

WRITE TODAY for complete information, prices and discounts on MIRALUMES to: Hygrade Sylvania Corp., Miralume Dept. EC6, Ipswich, Mass.—or your Electrical Wholesaler.

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Shrewd buyers
keep their copies
next to their olecranons*

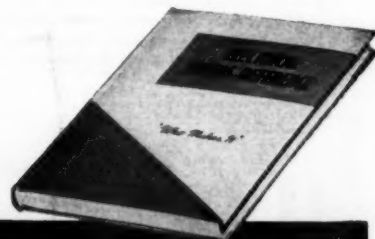
Who else makes it? Maybe there's
a better way.....a corner that
can be cut.....

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allied products, by company,
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for that certain one.....that
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copy handy!

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Electrical **BUYERS REFERENCE** •

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When you have to hunch a pipe to make a fit you want pipe that can take it. Here's the place where Youngstown Buckeye Conduit stands back of you.

That's mostly a matter of steel -- good quality steel, well made. Youngstown is the largest manufacturer of conduit in America, manufactures its own steel, and is in a position to pick the right grade for conduit. Fabricated into Youngstown Buckeye Conduit, certain essential qualities you demand are outstanding. Buckeye Conduit won't flatten on a radius, no worry over pinched cables. It won't fight a hickey, there is no back lash and men can make faster time, do better work. The specially tough but flexible lacquer lets you pull cables without the resistance of a cracked lining, and fish wire will not cut its satin smooth finish.

Youngstown Buckeye Conduit lives up to the Youngstown reputation. Buy Buckeye for better work, faster time, and more profit on the estimate.

Conduit - Pipe and Tubular Products - Sheets
Plates - Tin Plate - Bars - Rods - Wire - Nails
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26-8B



YOUNGSTOWN

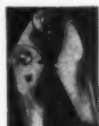
THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices: YOUNGSTOWN, OHIO

ANOTHER NATURAL!

NEW IDEAL BX Armor Cutter

Strips BX armor in one simple operation! No more nicked insulation—shorts—or wasted BX. Jaws take BX cable of any make, 2 or 3 wire, No. 12 or No. 14. Handy pocket size. Inexpensive. See one at your jobber's!



NEW IDEAL "Snap-Tite" SWITCHBOX SUPPORT

Just the thing for mounting any standard sectional switchbox in composition walls—Celotex, Nu-Wood, Plaster Board, etc. No screws or special tools required. Fastenings are all outside of box. Leaves all box space for wiring. Easy to install—easy to remove. Inexpensive! Investigate today.



IDEAL Wire-Nuts

Solderless-Tapeless Wire Connectors

Going out after those re-wiring jobs—with the new small-diameter wire? Then "Wire-Nuts" are just what you want for making better, less expensive wire joints. No fuss—no bother: Strip wires—screw on—THAT'S ALL! You'll like 'em for wiring fluorescent lighting fixtures, and a hundred-and-one other wiring jobs, too. Fully Approved: Listed by Underwriters' Laboratories, Inc. See your jobber or write today for particulars.



IDEAL FISH TAPE, REEL and PULLER

No tape breakage or live contacts. Cost and trouble of fishing minimized. 7 sizes available. Junior size: \$2.50.

Ask About These Other MONEY MAKERS
"E-Z" Wire Strippers—Easily strip toughest insulation without nicking or cutting strands.
Joint Boring Machine—NEW! Adjustable to 11 ft. height. Comes knocked down, ready for assembly.
Cable Ripper and Wire Gauge: Cleanly rips non-metallic, sheathed duplex or lead covered cable.

IDEAL SOLD THROUGH JOBBERS

Electrical Products Division
Ideal Commutator Dresser Company
1041 Park Avenue Sycamore, Illinois
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* See 1939-1940 Buyers' Reference number of Electrical Contracting for additional information on these companies and their products.

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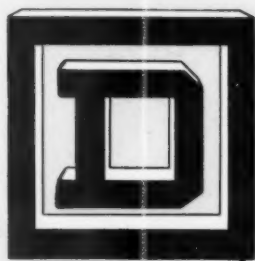
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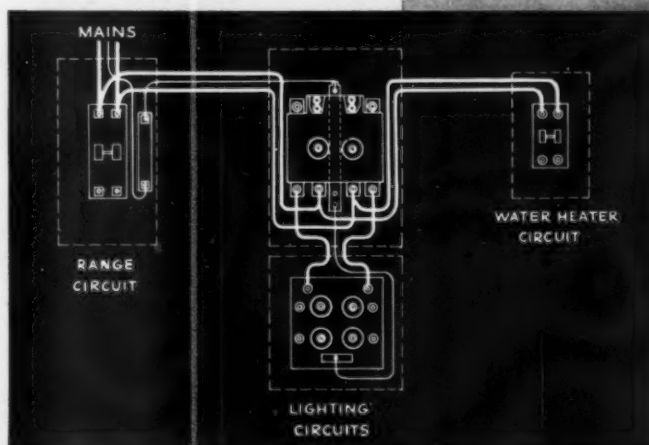
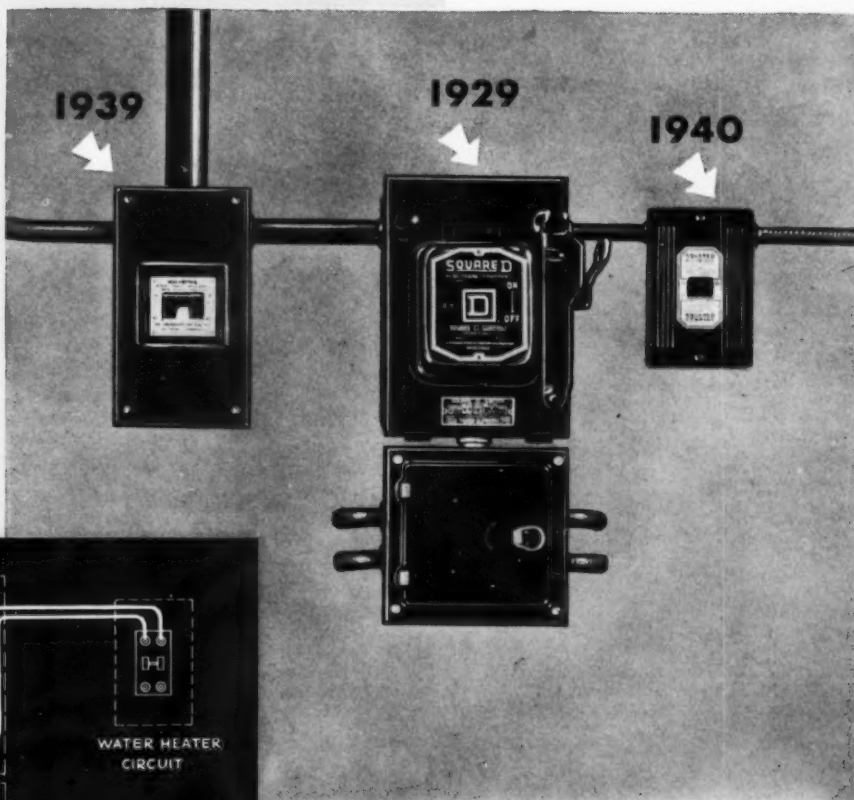
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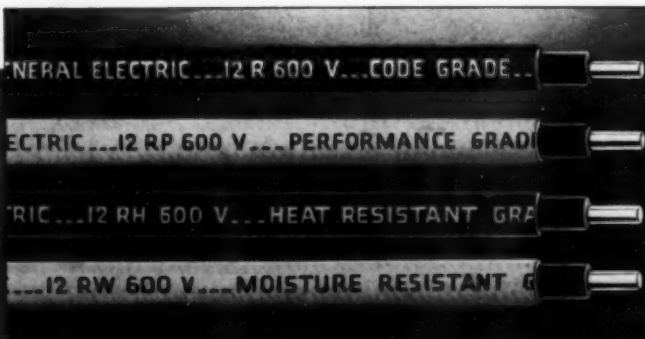
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